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HIFI NEWS

FEBRUARY, 1975
AUST 80c NZ 80c

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VOLUME 36 No 11

The Kenwood 700T frequency synthesising FM/stereo tuner, one of a new generation of advanced FM tuners now coming onto the market. You can read all about the design of this tuner in the article beginning on page 15.

Developed in our laboratory, this versatile function generator uses just two ICs and can generate square, triangle and sinusoidal waveforms over the full audio frequency range. Full constructional article commences on page 50.

On the cover

Probably the smallest TV cameras in the world, these minute cameras can spot a hairline crack on the inside of a pipe as small as 50mm in diameter, or can be used to examine structures under 135 metres of water. Each may be fitted with a forward viewing head or with a motorised reversible mirror rotating through 360 deg for axial viewing inside tubular spaces. The cameras were developed by Rees Instruments Ltd, Surrey, England.

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Editorial Viewpoint

Electronic music—tip of an iceberg

Whenever the subject of electronic musical instruments crops up, most of us think only of organs, guitars, or perhaps of synthesisers. This is understandable, because it is these three types of electronic instruments which to date have made the most impact on our musical culture. But it is becoming apparent increasingly that they represent only the start of a deep, and possibly quite profound, involvement of electronics in music.

Already there are signs that the electronic piano is going to bloom quite dramatically in the next few years. Thanks to modern IC technology, it is now possible to produce an instrument which is lighter and more compact than a conventional piano, with virtually permanent tuning, and the facility for "quiet" practising using headphones—for considerably less that the cost of a good conventional instrument. While at present the key touch may not be capable of quite the degree of interpretive flexibility provided by a good conventional piano, this will no doubt be achieved before very long.

There are signs also that electronic technology is evolving more new instruments of its own, quite apart from new versions of existing instruments. At a local school concert a few weeks ago, I noted that some of the pupils were playing quite a variety of unfamiliar instruments—some with bowed or plucked strings, others with small keyboards, but all linked by cables to familiar-looking speaker boxes.

And of course the electronic organ itself continues to evolve, becoming more than ever the keystone of do-it-yourself musical entertainment in modern homes. It is gradually making ground in the concert sphere also, as witnessed by the recent installation of a large Rogers instrument in Carnegie Hall (see page 9). It seems destined ultimately to challenge the pipe organ even at the highest level, once the solution is found to the remaining problems.

In short, we think you've seen only the tip of the iceberg as far as electronic musical instruments are concerned. There are likely to be some very interesting developments in this area, and we'll be aiming to keep you in touch.

Jamieson Rowe

EDITOR-IN-CHIEF
Neville Williams
M.I.R.E.E. (Aust.) (VK2XV)

EDITOR
Jamieson Rowe
B.A. (Sydney), B.Sc. (Technology, NSW)
M.I.R.E.E. (Aust) (VK2ZLO/T)

ASSISTANT EDITOR
Philip Watson
A.M.I.R.E.E. (Aust.) (VK2ZPW)

SCIENCE FEATURES
Greg Swain, B.Sc. (Hons, Sydney)

PRODUCT REVIEWS
Leo Simpson

TECHNICAL PROJECTS
David Edwards, B.E. (Hons, Tasmania)
Ian Pogson (VK2AZN/T)

GRAPHICS
Robert Flynn

PRODUCTION
Ross Tester

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

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12th Floor, 235 — 243 Jones Street, Broadway, Sydney, 2007. Phone 2 0944. Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57-59 Regent St, Sydney 2008. Phone: 699 3622.
Representative: Mike Avey.
Melbourne — 425 St Kilda Road, Melbourne, 3004. Phone: 267 3800.
Representative: Noel Fitzpatrick.
Adelaide — Charles F. Brown & Associates Ltd, 429 Pulteney Street, Adelaide 5000.
Representative: Tom Duffy 23 1657.
Perth — 454 Murray Street, Perth 6000.
Representative: Jack Hansen. 21 8217.

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The Multicon range is quality approved to DEF-5321; is available in combinations with from 2 to 33 poles and offers many improved features compared with types of similar construction. Contacts are heavily silver plated to ensure maximum contact efficiency. Split limb clips provide four individual areas of contact with each plug blade. Other features include moulded terminal numbering and moulded distance pips to avoid moisture build up between mated plug and socket which is instrumental in superior tropical performance.

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A standardised range is available ex stock. Literature is available on request to the Professional Components Division.

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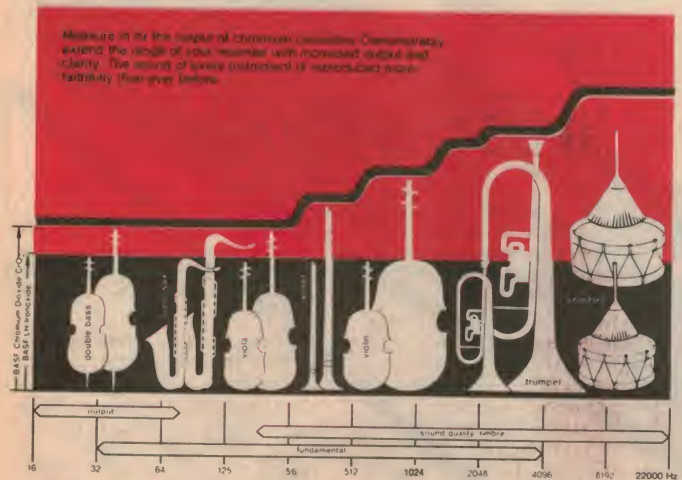
AC87/R2HOLT

BASF 'chrome' puts the polish on cassette sound

(Some say you can almost hear your face in it!)



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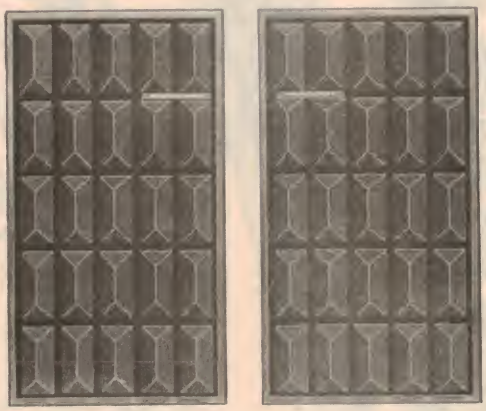

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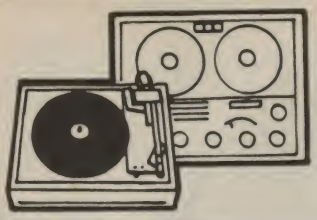


Hi Fi News

How to deal with dirty discs!

There are good grounds for the claim that vinyl discs are capable of a better signal/noise ratio than any other competitive home recording medium. Whether the potential is realised depends partly on the quality of the disc as manufactured, and partly on the way it is handled and played in the home. Decca's contribution to record care is a special brush designed to remove dust and surface charges without recourse to fluids.

by NEVILLE WILLIAMS

The 78rpm "shellac" discs of a past era were notoriously noisy, mainly because they were pressed from two or more ingredients serving the role of a binder and a filler—made necessary by the heavy playing weight and the steel needles of the day. Discrete "filler" particles, rubbing against the needle point, produced the familiar and continuous "sandpaper" background noise. Against such a background, a few extra particles of external dust on the surface of the disc, weren't all that obvious.

The vinyl used in modern discs is an homogeneous material, virtually free of discrete particles. Under good conditions, a polished, lightly loaded stylus can glide along the grooves so smoothly that the noise contributed by the tracing action is virtually below audibility, when compared with the program material. It can be less, for example, than the noise contributed by the tape sources from which the program is derived.

This is all to the good but . . .

With the elimination of inherent tracing noise, any clicks and plops produced as the stylus passes over flaws or foreign particles on the surface become more obvious, and can compromise the new found enjoyment of "music out of silence".

Furthermore, the groove dimensions of a modern recording and stylus are only about one-third those of the older system which means that, proportionately, flaws or dust particles in the grooves loom three times as large. And because the effective amplification between groove pattern and loudspeaker is much higher, the plop made by a given flaw or particle comes through that much louder—in one speaker, or two, or even four in a quadraphonic system!

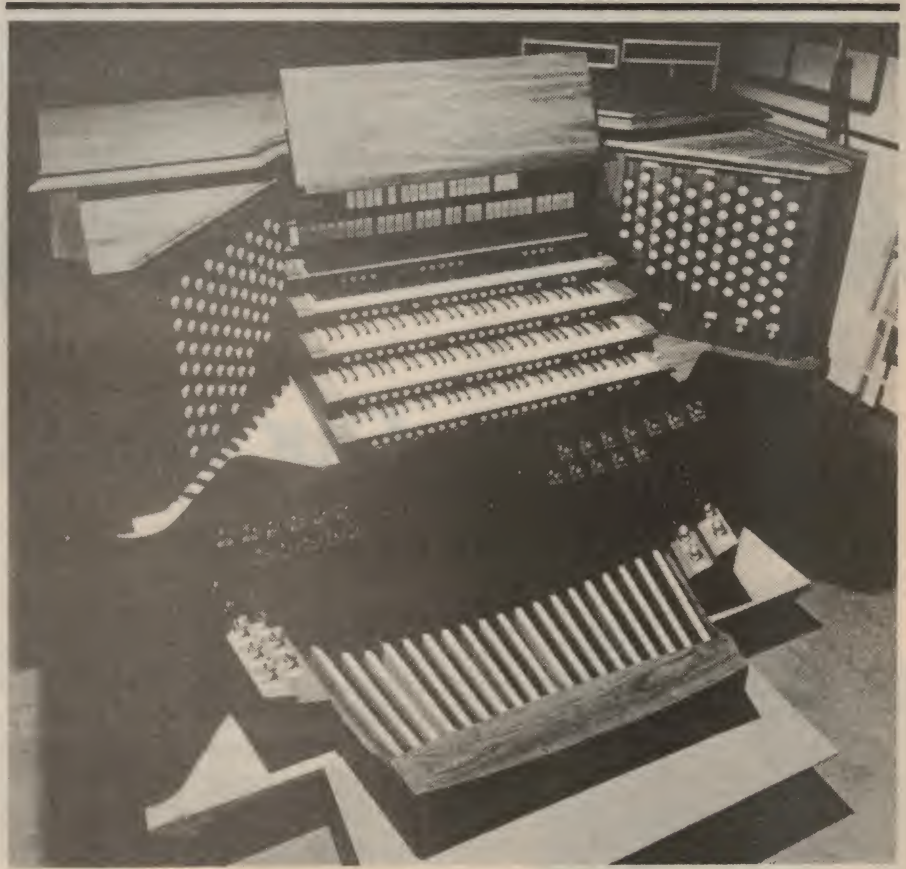
The obvious point that emerges from this is that modern disc recordings should be handled with care if they are to afford the enjoyment which they potentially have to offer; the surface must be protected from scratches, and from contamination by dust or other foreign material.

But how much care? Here the matter becomes highly subjective.

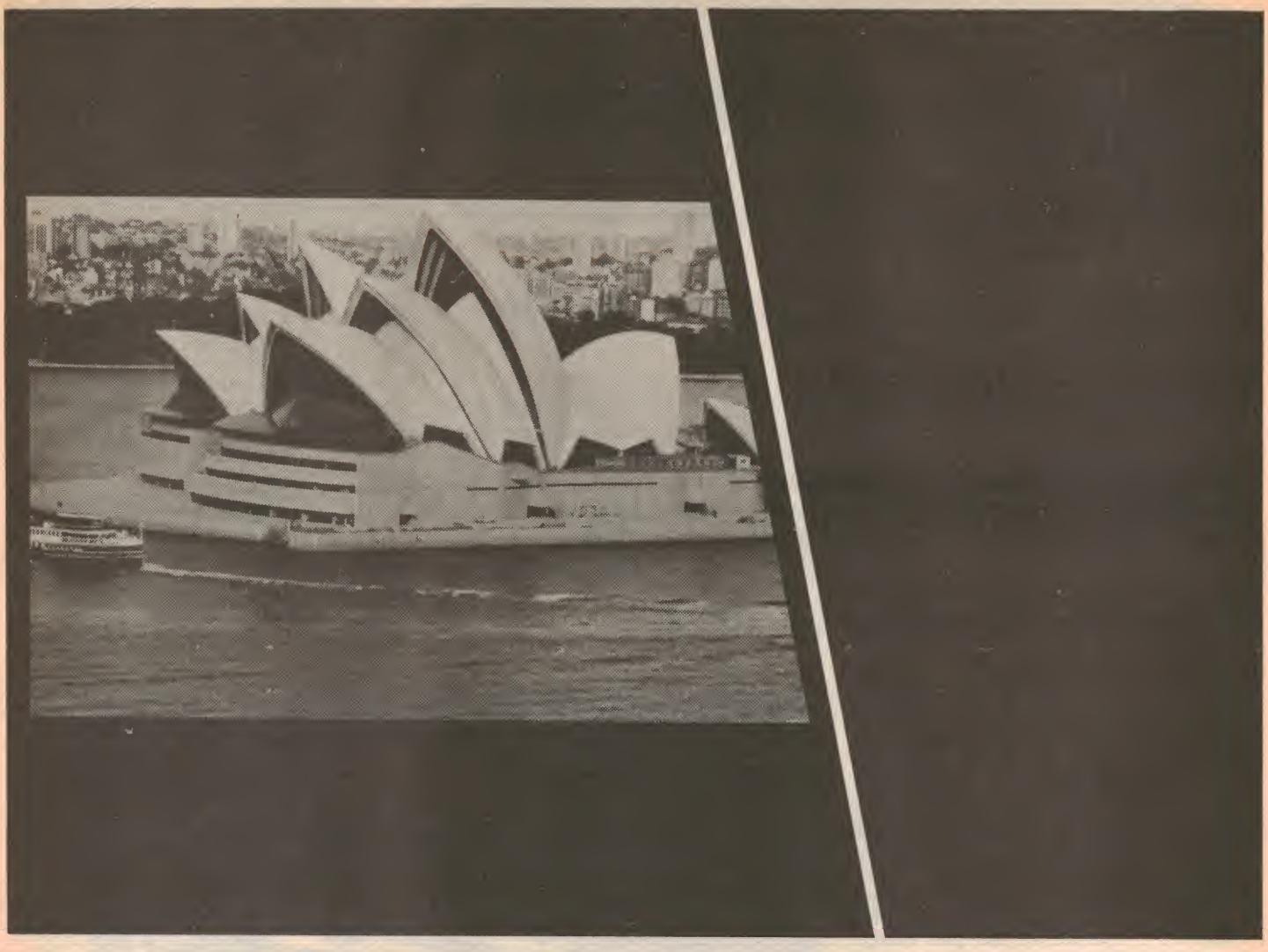
Just as there are people who leave records lying around bare on dusty furniture, there are those who go to the other extreme, seemingly paying as much attention to the state of the discs as to the programs they carry! One gets the impression of such people listening in a constant state of tension lest the flow of music be interrupted by a single heinous click! They go to extraordinary lengths to clean and protect the surface of their discs, disdaining the simpler measures which most enthusiasts regard as adequate.

Without seeking in any way to condemn this order of enthusiasm, those who exhibit it scarcely need to be informed about the elements of record hygiene or about aids which are commonly sold for the purpose. They are already experts!

Starting with the basics, however, record



Probably the most ambitious ever electronic organ project, this 5-manual classically styled Rogers instrument is installed in the Carnegie Hall in New York. Designed to specifications by organist Virgil Fox, the instrument took just under 2 years to build, at a cost of around $200,000. It speaks through 192 loudspeakers, including 4 30in models, installed in 29 cabinets. It can be tuned to exact concert pitch and then varied by plus and minus 10Hz by turning a single knob. The console can be rolled on a platform to any part of the stage, or lowered out of sight by an elevator when not required.



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AEO92/FP

hygiene really begins before the disc is even taken from its jacket. Has the album been properly stored or is there a layer of dust on the jacket, particularly near the open end? Are your hands clean? Is the turntable clean on which the record will rest? Is there a risk of cigarette ash falling on the disc, or dust from a window curtain, or pollen from flowers?

There is a double significance to these questions because not only can dust particles fall naturally on to a disc but they can be actively attracted to it by static charges which tend to accumulate on the vinyl surface—particularly in areas where humidity is low.

Well known audio writer, Percy Wilson, suggests that the problem can be further aggravated if the surface of the disc has been rendered in any way sticky by overzealous use in the room of an aerosol spray, excessive concentration of cooking vapours, or even condensates from heavy tobacco smoke. Dust is bad enough but "sticky dust" is far worse!

Fairly obviously, ordinary care and commonsense can obviate the need for a lot of subsequent cleaning: a case of prevention being better than cure!

The actual method of handling a disc is no less important, the basic objective being to eliminate all unnecessary contact with the groove area. The disc must rest on the turntable, of course, but it should certainly not be laid on a table or a settee, while one attends to something that has been overlooked. Nor is it wise to touch the recorded surface with the fingers, since the oily residue which constitutes a fingermark can harbour dust particles.

This may sound fussy, but how one handles a record is less a matter of the trouble it involves, than of simply getting into the appropriate habit or routine. Overall, methodical handling probably saves time as well as records!

A recommended handling routine is as follows: Starting with the jacketed disc, buckle the cardboard sides slightly by pressing one edge of the jacket against the body, allowing the sleeve and disc to be withdrawn.

Now slide a hand into the sleeve until the edge of the disc nestles in the "V" between the thumb and forefinger. The fingertips below the disc will now fall naturally on the label and, by crooking the hand slightly, the disc will be supported firmly without any contact with the groove area.

Remove the sleeve and lay it aside. The fingers of the free hand can now be pressed against the edge of the disc so that, with a little manipulation, it is being supported by the edge between the fingers of both hands. Guide it over the turntable spindle and the job is done.

If possible and convenient, play the record with the lid closed, and don't leave the disc exposed on the turntable when the number is finished.

After playing, the same handling procedure in reverse will restore the disc to its jacket, again without danger of fingermarking the groove area.

Even with this degree of care, it is likely that the surface may not be entirely dust-free and while it maybe "good enough" for some, many more fastidious listeners prefer to take further measures to avoid "playing" stray dust particles or grinding them into the record surface.

One "further measure" which is not recommended is the idea of blowing away dust particles with a hefty breath. It may get rid of the particles but it may also leave behind tiny droplets of saliva to which further particles can cling!

A much better idea—still a simple one—is to let the rotating disc run under a pad of very slightly moist cloth, which is applied near the label and gradually

AUDIO VISUAL SYSTEM FROM ELECTROSONIC

Electrosonic, a division of Convoy International Pty Ltd, has a new hardware package that allows sophisticated single screen presentations to be produced by almost anyone with a little knowledge of presentation techniques.

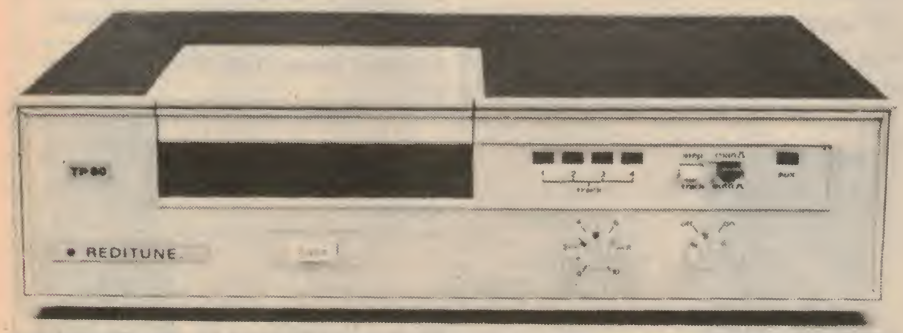
The package is made up of four units: a dissolve and program unit, a cassette recorder and two Kodak Carousel slide projectors. The units can be transported easily in three compact carry cases.

As such, they are ideal for use by advertising agencies, or by companies needing presentations for exhibitions, showrooms, etc. Other uses suggest themselves, including lectures, travel talks and so on.

A typical presentation can be put together by any reasonably resourceful person in 7 straightforward steps. Once the program is on cassette, the player provides the narration and background music, and also instructs the projectors when the dissolce, superimpose, etc.

The operator simply sets up the equipment, pops the cassette into the player and relaxes while the presentation continues automatically. (For further details contact Convoy Electrosonic Division, 4 Dowling St., Woolloomooloo, NSW 2011.)

AWA Rediffusion background music player



AWA Rediffusion's release of a new free standing background music player, the TP80, launches the Company's recently acquired Reditune background music service in Australia. The TP80 slim-line design is the result of extensive development work by Rediffusion Reditune, UK, and incorporates many new features including microphone input and 30 watt amplifier as standard. Reditune background music service is one of the world's largest with an extensive music library of more than 18,000 titles and arrangements, which are constantly being updated. AWA Rediffusion Pty Ltd is a joint company owned by Rediffusion Ltd, UK, and Amalgamated Wireless (Australasia) Limited.

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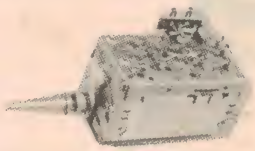

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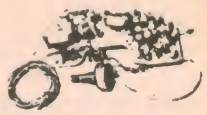

50/Ohm Pots ideal for ext. Speakers 50 cents. Transistor and Driver Speaker Transformers **$1.00** pair. Ferrite Rods 6½ x ½ inch **50 cents.**

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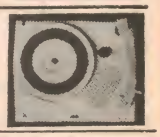

AWA 4 speed 240 V Gram Motor and Pickup $7.95

BSR Stereo Player Model P-128 $52 pack and post **$1.50** Interstate **$2.00**

Stereo Pickup Arm and Cartridge Balanced **$9.50**

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Screw in 6 Volt Pilot Lights **$1.50** for 10 Plug-in type 10 for **$1.00**

With about a million bristles pressing gently against the groove area, the new Decca record brush can not only pick up dust particles, but it can also dissipate surface charges which might attract more dust. Recommended retail price through record houses and hifi dealers is $12.50. (From British Merchandising Pty Ltd, 49-51 York St, Sydney 2001.)

moved outwards over the edge of the disc. A well laundered lint-free handkerchief, moistened with water, will pick up the most obvious surface particles. It is not wise to use a perfectly dry handkerchief because the friction may generate static charges and attract dust particles in even greater numbers.

Needless to say, not-so-clean and not-so-lint-free handkerchiefs must be avoided because they, too, can deposit more than they remove!

Much more effective and predictable are the various cloths which are sold for the purpose, usually in plastic cachettes. Most of them have a slightly "sticky" feel, because of their texture and likely impregnation with chemical. They should be used in the same way to wipe particles from the rotating record surface, working from the label outwards. It is not wise, however, to apply undue pressure or to scrub across the surface.

And the cloths should be put straight back into the cachette after use, and refolded every now and again to expose a new surface. Discard the cloths when there is any danger of them not being able to do the intended job.

Another approach is represented by gadgets like the "Dust Bug" invented by Cecil E. Watts and launched on the market around 1954. Such gadgets involve a tiny brush or a roller-shaped pad supported on an arm and placed on the disc at the same time as the pickup. In fact, some pickups even have the brush attached directly to the playing arm. The idea is to straddle the grooves that the stylus is playing, picking up particles before the stylus reaches them.

At best, such gadgets can be very good and, if properly mounted on the playing deck, the extra effort of using them on long playing albums is hardly noticed.

However, they can become a doubtful panacea in the hands of a careless user who forgets to rotate or clean the pad, except on rare occasions, or who simply drops the cleaning surface on to the deck between playings. So neglected, the active surface can itself become completely fouled with dust and fluff.

At the other extreme are people who soak the pad in the liquid that is sometimes supplied, and intended only to keep the pad vaguely moist—enough to dispel static charges.

While all sorts of claims have been made for anti-noise liquids, most authorities on record care advise against liquids or methods which significantly and repeatedly wet the surface of discs. They see the danger of a gradual build-up of deposits in the grooves from excessive use of "lubricants" and "anti-static" fluids.

The same objection is taken to cleaning cloths which are too heavily impregnated, and at all likely to leave a deposit within the actual grooves.

A "gummy" build-up in the grooves is undesirable on two counts: It may partially fill in fine, high frequency modulation patterns and it can also collect on the stylus as a hard-to-shift "varnish".

Suspicion of "damp" cleaning methods has ensured a strong following for devices which rely on a mechanical brushing action to dislodge particles in the grooves. A familiar gadget of this nature is in the form of a cylinder about 100mm long and 25mm diameter carrying on its surface a very fine pile. Held between the fingers against the grooves of a rotating disc, it will pick up foreign particles, which can then be wiped or blown from the surface of the cylinder. When not in use, it is (and must be) kept in a protective plastic sleeve.

The new Decca record brush carries this idea still further. It, too, is about 100mm long, wide enough to span the recorded area of a typical 12in LP disc. According to the manufacturers, the brush is made up of one million bristles, each 8/9 microns in diameter. They claim that, in a typical record cleaning operation, 1000 separate bristles run along each groove, effectively lifting out any loose, hidden particles.

In addition, the bristles are electrically conductive so that they tend to distribute and dispel any areas of static charge set up by previous handling of the disc.

Decca make a strong point of the fact that the dust and charge problems are both dealt with, without resource to fluids in any form. The brush itself must obviously be kept clean and, when not in use, should be kept on its metal stand. In fact, the stand includes a small rod which is intended to dislodge particles from the brush as it is picked up.

Long famous for their pickup cartridges, the Ortofon Company has now turned its attention to loudspeakers. There are three systems in the range: model 225, with 10in woofer and dome tweeter, a volume of 25 litres and a power rating of 45W RMS; model 335, 10in woofer, 5in mid range, dome tweeter, 35 litres and 50W; model 445, two 8.5in woofers, 5in mid range, dome tweeter, 45 litres, 90W. Rated frequency response in all cases is very wide. The systems have not yet been released in Australia but information will be available in due course from: Consumer Division, Rank Industries Aust Pty Ltd, 12 Barcoo St, Roseville East 2069.

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"LINTON 2". With a frequency response of 55-17,000 Hz. ± 3 dB. and a power handling capacity of 20 watts DIN, the compact "Linton 2" features a specially designed and sensitive 20 cm bass/mid range reproducer and a 5 cm high frequency unit. Size is only 48 x 25 x 24 cm. Ideal for floor or shelf In teak and walnut finishes

"MELTON 2". Features a very even frequency response from 45-17,000 Hz. ± 3 dB. and extends well beyond these figures. Handles 30 watts DIN with ease. Incorporates a 30 cm bass reproducer and a 5 cm mid-range treble unit, with crossover at 1500 Hz. Size is 53.5 x 37 x 26 cm. In teak and walnut finishes. For floor or shelf mounting.

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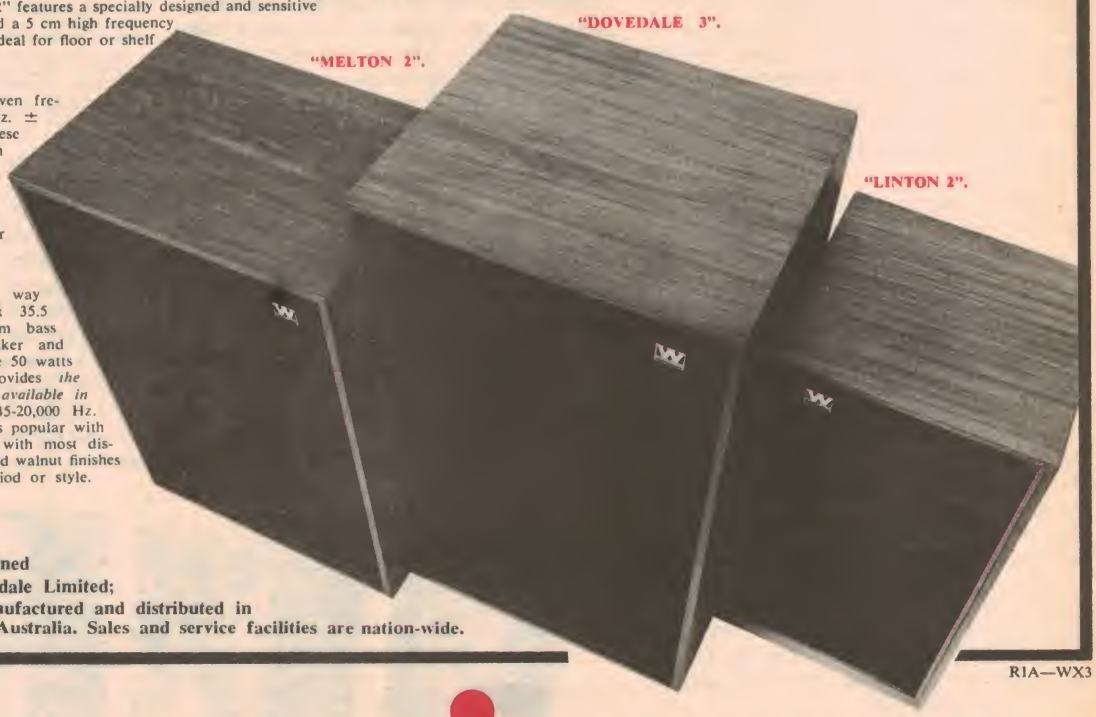

Wharfedale speakers are designed in the U.K. by Rank Wharfedale Limited; these fine reproducers are manufactured and distributed in Australia by Rank Industries Australia. Sales and service facilities are nation-wide.

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Advanced concepts in the new FM/Stereo tuner designs

While FM/Stereo radio has been operating for many years in many countries, equipment design has by no means reached the doldrums. Innovations include extensive metering facilities, phase locked loop circuits, noise blanking systems and frequency synthesis tuning. Epitomising this advanced—and expensive—design approach is the new Kenwood 700T frequency synthesising tuner described in this article.

by LEN FELDMAN*

The performance level of the typical all-in-one stereo hi-fi component receiver has improved remarkably over the last few years. Circuit refinements have been applied to both the amplifier sections and the FM tuner sections of the one-piece receiver, so that each of these sections now outperforms some of the better separate tuners and amplifiers of earlier years.

There are receivers which boast continuous power outputs of 100 watts per channel and more at less than 0.1% total harmonic distortion—specifications previously associated only with separate integrated amplifiers or even separate basic power amplifiers.

As for FM performance, it is not unusual to find integrated stereo FM receivers which offer ultimate signal-to-noise ratios well above 70dB, distortion levels (even at 100% modulation) of below 0.25%, and stereo separation capabilities of well over 40dB at mid-frequencies and better than 30dB over the entire audio range.

To justify the continued existence of the "separate" FM tuner, manufacturers of these relatively high-priced components have had to seek and develop improvements which extend beyond the commonly reported performance specifications and which offer operating convenience and simplicity to the prospective buyer that are not available in the popular all-in-one receiver component format.

Typical of this new breed of FM tuner is Kenwood's new model 700T Frequency Synthesizing Tuner, shown in Fig. 1.

Even the very best FM tuner which boasts low, low distortion can deliver its lowest THD figures only when the circuits in the front end are precisely tuned to the center frequency of the desired station signal.

Typical values of distortion introduced by even minimal mis-tuning of frequency are illustrated in the graph of Fig. 2. As this graph illustrates, a mis-tuning of as little as 50kHz can increase distortion in the output from 0.13% to 0.45% for monophonic signals. In stereo FM, the degradation of audio purity can be even greater.

Conventional tuners and receivers generally use center-of-channel tuning meters or other indicators as tuning aids. Often, such indicators are simply DC voltmeters hooked up to the take-off point of the FM ratio detector. In a properly aligned FM tuner, proper tuning should result in zero DC voltage at this point and the meter pointer is then centered.

Even slight misalignment of the ratio detector or other tuned circuits in the IF section of the tuner can cause the meter pointer to favour left or right of center and the user, relying upon this indication, would then deliberately mistune the set until the pointer returned to its mid-point.

Again, even in a perfectly aligned system, detector bandwidth on modern tuners is so great that the tuning meter's range, from end to end, must extend over several hundred kHz, making the exact "center point" rather difficult to determine visually.

The idea of using a frequency synthesizing circuit for accurate FM tuning is not new. It first appeared in a consumer type tuner a few years ago when the Heath AG-1510 tuner was introduced. That tuner was tuned with keyboard push-buttons and, therefore, required a great amount of digital circuitry beyond the relatively simple requirements of frequency synthesis. In addition, the AJ-1510 tuner displayed tuned frequencies on digital readout tubes, which also required a fair amount of digital drive circuitry.

Kenwood engineers, in designing the new 700T decided that audiophiles prefer to select frequencies with a conventional tuning knob and to read those frequencies on a printed dial scale; so the front panel layout of the new tuner is not unlike that of conventional tuners which use multi-section variable capacitors. What goes on behind the dial scale is quite different, however.

The block diagram of Fig. 3 shows the circuit elements of the RF front-end and the frequency synthesizer section. The front-end is quite conventional in that it includes two stages of tuned RF amplification, a mixer stage and a local oscillator. The local oscillator is tuned by varactor diodes, rather than the conventional variable capacitor. The DC voltage applied to the varactors determines their effective capacitance which, in turn, determines the frequency of the local oscillator.

The lower cluster of blocks in Fig. 3 represent the frequency synthesizer. First, the frequency of the local oscillator is divided by four through a 4:1 divider circuit. Thus, possible frequencies avail-

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Fig. 1: From the front, the Kenwood 700T looks conventional, although with more controls than usual. But the tuning is not continuous; it jumps in a series of crystal-locked increments which ensure that it must ultimately land "spot on" stations distributed conventionally across the VHF FM band. A 3-light tuning indicator system shows when the automatic frequency control is centred on the desired channel. Other lights indicate which of the various other facilities have been selected.

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able at the output of the divider will range from 24.68MHz to 29.68MHz. (Local oscillators in FM sets are tuned to 10.7MHz above the incoming frequency, so that the range of an FM local oscillator extends from 98.7MHz to 118.7MHz.)

The output of a crystal-controlled oscillator, tuned to 2MHz, is divided in an 80:1 divider circuit to produce an accurate and constant output at 25kHz. The outputs of both dividers are translated to narrow digital pulses. Both sets of pulses are applied to the inputs of a comparator circuit.

So long as there is an exact whole number of pulses of divided-down local oscillator signal compared to a single 25kHz pulse from the divided down 2MHz signal source, a prescribed value of DC voltage appears at the output of the phase comparator. If mistuning occurs, and the frequency or phase relationship changes between the two sets of pulses, the DC output of the comparator changes—not linearly, but in finite steps, as illustrated in Fig. 4.

The DC output of the comparator is amplified by a DC amplifier and the resulting DC voltage is used to "tune" the local oscillator in the front end. This concept of discrete steps of voltage rather than continuously variable tuning voltage is what makes this electronically tuned system different from other varactor-tuned FM sets.

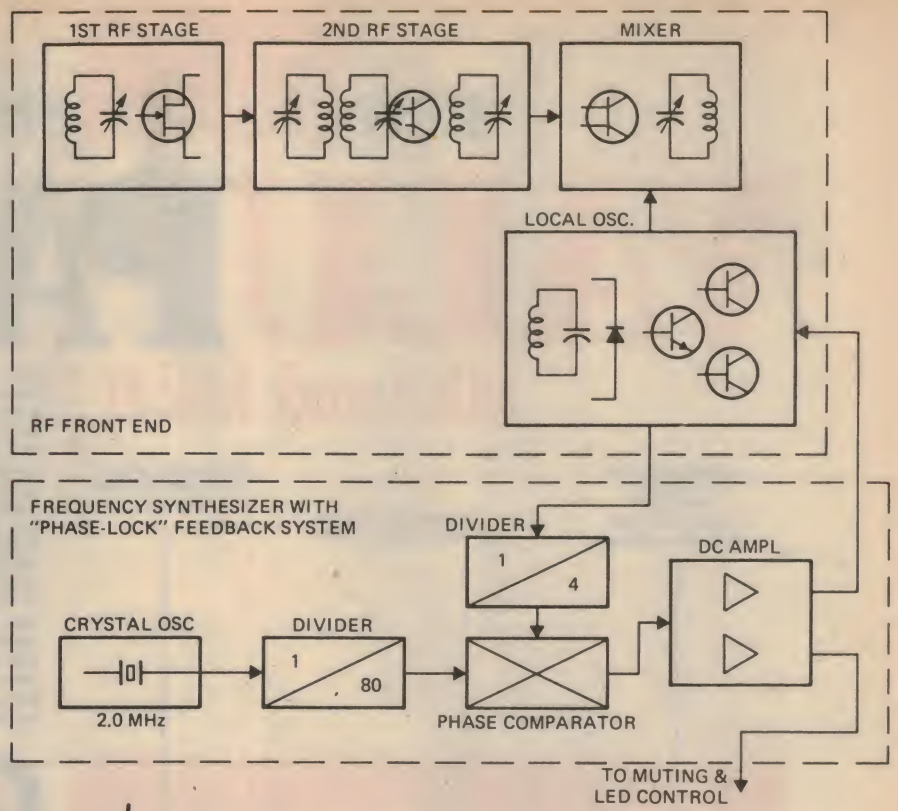

Fig. 3 (above): A block diagram of the front end and the frequency synthesiser section of the new Kenwood 700T FM / Stereo tuner. The system retains the appeal of an ostensibly normal tuning knob but virtually eliminates problems of mistuning.

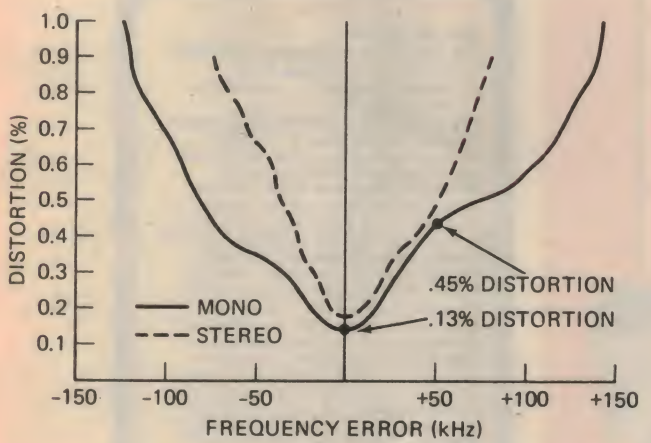

Fig. 2 (left): Distortion increases rapidly with mistuning of an FM receiver. The rise is more noticeable with stereo (dotted curve) than with mono.

It is very much analogous to the "phase-lock-loop" concept used in the multiplex sections of this and other tuners, in that there is a finite "lock-in" range of the system. Essentially, if the local oscillator is tuned to less than ±100kHz of the desired frequency, the system pulls the oscillator to exact desired center frequency. Once tuned beyond 100kHz to either side of center, the stepped DC voltage forces the oscillator to jump in frequency to the next, discrete, FM channel frequency.

Accuracy of tuning is dependent only upon the accuracy of the 2MHz crystal oscillator which is used to create the 25kHz reference pulses. That crystal is accurate enough to provide an overall tuning accuracy of 0.0024%. At a desired tuning frequency of 100MHz, that means that the maximum error of tuning possible is 2.4kHz, hardly enough to alter the distortion of the audio output signal by a measurable amount.

To provide the user with a positive indication of tuning accuracy, the 700T is equipped with a two-step muting and LED control unit (not shown in the block diagram of Fig. 3). This circuit receives inputs from the frequency synthesizer as well as from a special noise-sensing circuit in the IF section of the tuner. Muting threshold is, therefore, dependent not only on signal strength (determined by signal noise content), but on accuracy of tuning as well. The three LED indicators seen at the right of the signal strength meter in Fig. 1 light when a station signal is received, with the outermost, red colored ones denoting a mistuning of 100kHz and the center green indicator denoting perfect, on-center tuning.

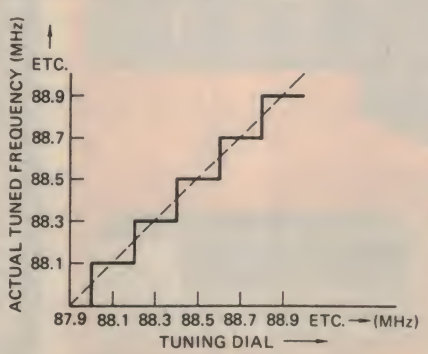

Fig. 4: Conventional tuning provides a continuous relationship between the dial setting and the frequency to which the receiver is adjusted. In the Kenwood 700T, the tuning jumps in precise, crystal controlled increments as the dial is rotated.

Another novel circuit designed into the 700T tuner is called PNBS (Pulse Noise Blanking System). Its purpose is to substantially reduce the audible effects of noise pulses which might be generated by man-made interference such as motor ignition noises.

A block diagram illustrating the operation of this circuit is in Fig. 5. The noise amplifier and first comparator stage at the left of the diagram are fed a detected IF signal from the IF section of the tuner. The output of this first comparator is arranged to drive the other elements of the system so that in the presence of a weak signal (which might otherwise be interpreted as "noise pulses"), the main gating circuit in the audio amplifier stages permits the audio to come through.

At stronger signal levels, the real operation of the PNBS system comes into play. The FM noise amplifier feeds a diode

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We've given you a brief outline on Sansui's Valupaks Mk. I and Mk. II. You can hear the startling difference Sansui quality makes when you listen to these Sansui units at your nearest specialist hi-fi store.

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switch which is now set to pass inputs from this source. The output of the switch is fed to a highpass filter which has a cutoff frequency of 150kHz.

The noise pulses contain frequency components beyond 150kHz and are, therefore, amplified and sent on to the second comparator which is in reality a form of pulse detector. The resulting pulses are passed through an integrator where they are shaped into lower-frequency square shaped DC pulses.

These pulses are then applied to the final comparator and on to a dual gating circuit which is positioned between stages of the audio amplifier section of the tuner. When a shaped pulse is applied to this gating circuit, it effectively interrupts the passage of the audio signals for a very short time, thereby blocking the otherwise audible noise pulse.

The series of waveforms shown in Fig. 6 illustrates the appearance of the IF signal and the resultant audio. An IF signal without noise is represented by the upper waveform. Pulse noise alters the waveform so that it appears as in the second diagram.

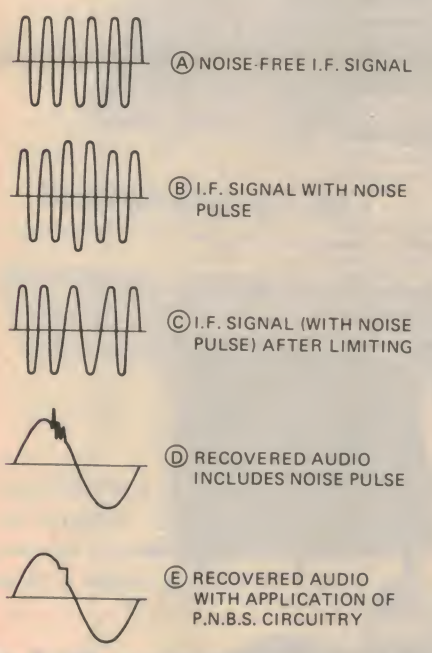

Fig. 6: While amplitude limiting in the IF chain of an FM receiver may eliminate amplitude variations (b) disturbances to the apparent frequency of the signal (c) can give rise to a noise pulse in the recovered audio. (d) The PNBS provision can interrupt the audio signal for the duration of a noise pulse, producing a much less obvious diversion.

Even though the limiter stages of the IF system remove the AM variations caused by the noise pulse, the constant-amplitude IF signal at the output of the limiters now contains frequency disturbances which correspond to the noise and which would ordinarily be detected by the ratio-detector as audible noise, as represented by the single sine wave (recovered audio) shown next.

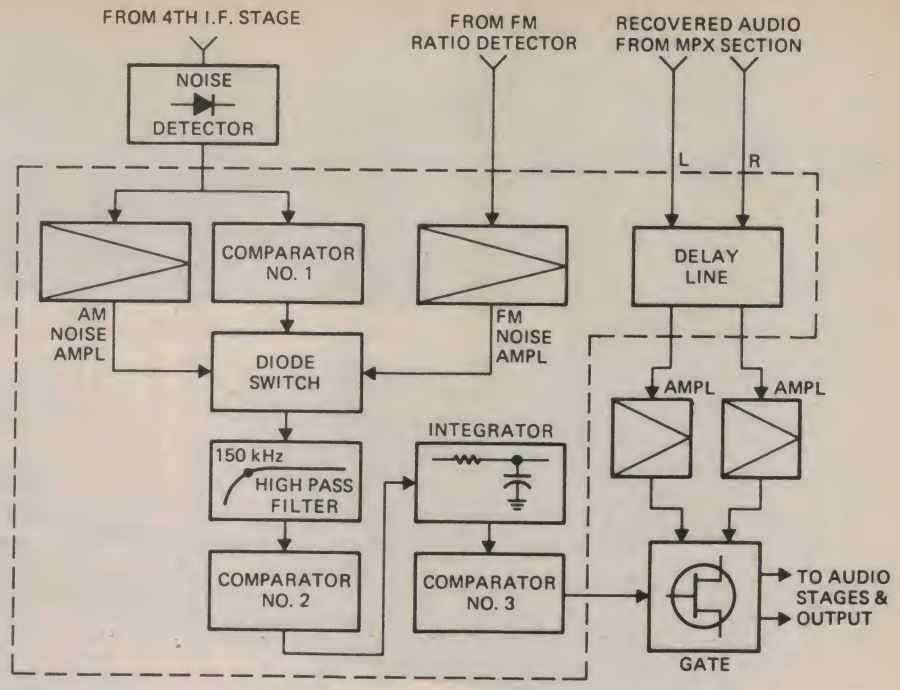

Fig. 5: Block diagram of the pulse noise blanking system used in the Kenwood 700T tuner, referred to on the panel as PNBS. While conventional FM technology gives a substantial degree of protection against noise interference, compared with an AM system, strong pulses from car ignition or electrical equipment can get through, being particularly annoying if the program is being recorded. The PNBS circuitry gives an additional measure of protection.

The PNBS circuit has a "smoothing" effect on the audio waveform and, while it does not eliminate the "break" in the normal audio sinewave, the audible effects of this kind of smooth disparity in the waveform are far less annoying to the listener.

The various circuits involved in the PNBS section (and especially the highpass filter) introduce a time delay of a few microseconds. Thus, the gating voltage which finally "turns off" the gate circuit in the audio amplifier section arrives a small fraction of a second after the noise pulse arriving from the two outputs of the stereo decoder section.

If this were not compensated for, the audible noise pulse would "sneak through" before the gating circuit was turned off. Accordingly, a time-delay circuit is introduced ahead of the audio amplifier section so that the arrival of the gate pulse coincides exactly with the arrival of the noise pulse from the audio amplifier inputs to the gating circuit.

Like other state-of-the-art FM tuners currently available, the 700T uses a phase-lock-loop circuit in its multiplex stereo section.

In addition, the 38-kHz switching circuitry used to demodulate the composite stereo signal into separate left and right outputs consists of two, 180° phase displaced switching circuits, each fed with appropriately phased audio composite signals. This arrangement tends to maintain better phase accuracy (and therefore better separation) at high audio frequencies and also reduces or cancels residual carrier products at the audio outputs of the system.

Kenwood has been using this circuit in a variety of its products in the past, but this represents its first use in combination with a phase-lock-loop arrangement for maintaining the critical phase relationship between the 19kHz pilot signal and the audio sub-carrier sidebands of the stereo composite signal.

The signal strength meter on the 700T serves a second function. By depressing a front panel button it is transformed into a multipath indicator meter, facilitating proper orientation of an FM antenna for least interference from signal reflections. A pair of jacks at the back of the tuner permit connection of an oscilloscope for visual observation (and correction) of multipath effects, thus permitting greater antenna orientation accuracy.

As for more familiar performance specifications, the 700T attributes these to its unique circuit innovations. Harmonic distortion is stated as 0.15% in mono and 0.25% in stereo. Quieting slope is so steep that with a signal input of only 1.8μV, S/N (signal-to-noise) ratio is 40dB while with only 200μV of signal applied, S/N ratio is at least 73dB. The elaborate stereo decoder section provides 45dB of channel separation at 1kHz and maintains separation capability of at least 35dB at 10kHz.

Obviously, one could buy a pretty good receiver for the $700.00 selling price of the FM/AM tuner (in USA). But the hi-fi audience is such that there will always be those willing to pay a premium price for that last bit of perfection and for the unique features built into a product such as Kenwood's 700T.

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(b) An input load which is a pure resistance at all frequencies. 5° 0-20 KHZ.

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2 Digital mastertapes for disc cutting and further refinement of the pickup cartridge will lead to lower noise and less distortion, and may make a major contribution to better sound in the next decade. The Quad 33 can do full justice to each and all of these possibilities.

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Sony TC-177SD has dual capstans and three heads

Three heads are normal on high-quality open-reel tape decks but have only recently become available on "prestige" stereo cassette decks. Here we review for the first time a three-head, dual capstan stereo cassette deck, the Sony TC-177SD.

A photograph of the Sony TC-177SD along with its less pretentious stablemate, the TC-137SD, was featured on the front cover of the October 1973 issue of "Electronics Australia". In the "Hifi News" pages of that same issue we gave a description of some of the features of these models. However, some considerable time has passed between writing that description from supplied literature and actually being able to test a machine. So it was with considerable interest that we approached this review of the TC-177SD.

In keeping with its status as the top-of-the-line Sony cassette machine, the TC-177SD is the largest and the heaviest. Its overall dimensions are 435 x 155 x 325mm (W x H x D) and weight is 10kg. Semiconductor complement is impressive with 12 integrated circuits, 2 FETs, 55 bipolar transistors and 46 diodes including the light-emitting diode used as peak overload indicator.

Apart from size, perhaps the most impressive feature of the Sony TC-177SD is the transport mechanism. It has a large 6-pole hysteresis synchronous motor, which drives the two heavy flywheels for the capstans via a common rectangular section belt. The two capstans revolve at slightly different speeds to keep the section of tape passing the heads in tension, so that low wow and flutter performance is achieved regardless of vagaries in cassette winding tension.

Deck control is performed by mechanically interlocked push-buttons which are linked to several solenoids and microswitches. The solenoids enable lighter and faster operation of the deck than is possible using mechanical action, where the operator does all the "work".

Automatic stop is provided for all modes of the transport mechanism. The deck has a tape-motion sensor which immediately trips a solenoid to stop the mechanism at end of tape. The motion sensor consists of a pulley which also carries the belt for the revolution counter and has a ferrite magnetic rim positioned close to a Hall effect integrated circuit. The IC generates a signal while ever the tape is in motion. Lack of such signals cause the Stop solenoid to be tripped.

In addition, the deck has the now common Memory feature whereby the tape can be rewound to a preset "000" on the revolution counter and then stop. This is desirable where a given section of a tape cassette needs to be repeated.

There were two features of the cassette compartment that we liked. First, there is a light behind the cassette which lets you view the progress of the tape. Second, pressing the Eject button while the tape is in motion flips up the cassette lid for even easier viewing. This is quite a change from some cassette decks which have unlighted compartments, heavily tinted lids and no way of flipping them up while the cassette is inside.

One feature of the deck we did not like was the rather abrupt way in which the cassette is ejected with such a clatter. Why does it have to eject the cassette with such undignified alacrity? Surely it should be possible to eject the cassette more quietly and gently.

A large amount of circuity is accommodated on PC boards inside, but removing the base cover from the machine still gives a reasonable degree of access for maintenance or adjustments.

Since the TC-177SD has separate recording and playback heads and completely separate circuitry associated with each head, it is possible to monitor and assess the quality of signals as they are recorded onto the tape and this applies even when Dolby noise reduction is being used.

We understand that with at least one other three-head cassette deck it is only possible to monitor Dolbyised recordings as they are made, in the pre-emphasised state. This means that the monitor quality during Dolbyised recordings must be brighter than usual, if not harsh.

Another advantage is obtained by virtue of having three heads in that the gap in the playback head can be narrower than the optimum for a combined record/playback head. And apparently Sony's use of ferrite in the playback head (it's also used in the other heads) means that the

(continued on page 23)

Hiss or Miss no more

TC134SD
Dolbyized Stereo Cassette Deck with Ferrite and Ferrite Heads for unrivalled recording and playback. Features include: Limiter recording system, Dolby Noise Reduction*, automatic full mode shut-off mechanism; tape selector switch. **System:** 4 track 2-channel stereo recording and playback; **Power requirements:** 240V AC, 50Hz, 10W; **Frequency response:** Cr02 30Hz-17KHz, Normal 30Hz-15KHz S/N ratio: Dolby off: 49dB; **Flutter and wow:** less than 0.2%; **Harmonic distortion:** 2.5%. **Inputs:** Microphone −72dB (0.2mV) low impedance, Line −22dB (0.06V) 680K ohms, Rec/PB 3.3K ohms. **Dimensions** 412 (W) x 115 (H) x 223mm (D). Weight: 5.3Kg.

TC131SD
A quality Dolbyized deck at a sensible price. Features include: Dolby Noise Reduction*, Ferrite and Ferrite heads, complete automatic shut off, high performance limiter recording, Cr02 or normal cassettes, direct-coupling circuit for the heads, locking pause control. **System:** 4 track, 2-channel stereo recording and playback. **Harmonic distortion:** 2.5%. **Power requirements:** 240V AC, 50 Hz. **Frequency response:** Cr02 40Hz-15KHz, Normal 40Hz-13KHz. S/N ratio: Dolby off: 48dB. **Flutter and wow:** less than 0.22%. **Inputs:** microphone (−72dB, 0.2mV sensitivity, low impedance); line (−22dB, 0.6V sensitivity, 100K ohm impedance or more); Rec/PB (10K ohms or less). **Outputs:** Line: 0dB (0.775V) 10K ohms or more; Headphone: −28dB, 8 ohms; Rec/PB 50K ohms; **Dimensions:** 388 (W) x 95 (H) x 230mm (D); Weight: 4.5Kg.

*The word Dolby is a trademark of Dolby Laboratories, Inc.

SONY. for particular people

TC131/TC134

gap is easier to manufacture to close tolerances and less likely to deteriorate due to wear.

A recording limiter push-button is featured on the TC-177SD as on other Sony casssette decks. When switched in it does not affect signals below OdB but acts with fast attack and slow decay to compress signals above OdB. As such it is very effective as an aid to clean distortion-free recordings.

Also very effective is the LED peak overload indicator which flashes when the recording level exceeds plus 5dB in either channel. We would have preferred separate overload indicators for each channel, considering the price tag on this machine.

Not included on most cassette decks are top panel Dolby calibration controls and inbuilt 400Hz reference tone source. This is very handy for optimising the Dolby levels to suit various tapes.

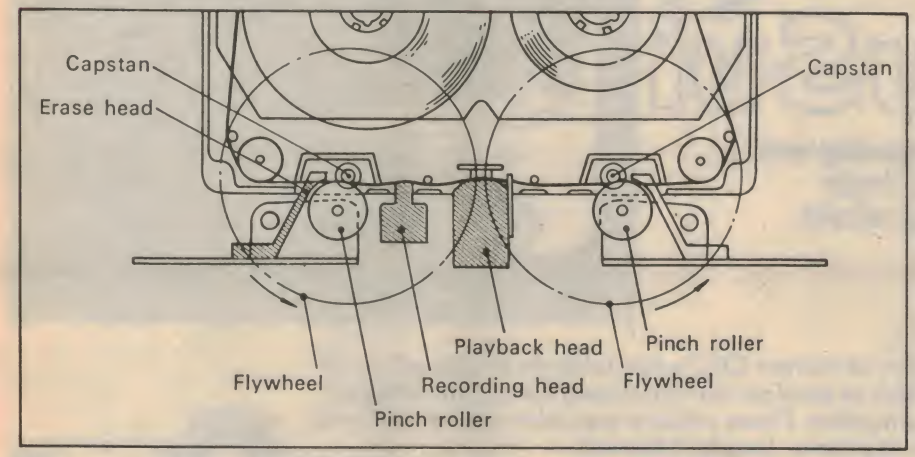
Three-position switches are provided for bias and equalisation setting. As well as providing for low-noise, high output ferric tapes and chromium-dioxide tapes, the TC-177SD provides for the new tape formulation, ferric chrome which is made by Sony and a few other manufacturers.

While we think every user would prefer a cassette deck with solenoid control, we did find some drawbacks with the Sony system. For a start, it is not possible to use the Sony TC-177SD with a remote control unit. One would have thought this an "obvious" optional accessory.

We also found that the solenoid action has a slight delay between pressing a button and actuation which can be a little irritating after becoming used to the apparently instantaneous actuation of other machines with solenoid control.

Aside from that, we found no perceptible delay between the time of solenoid actuation (ie, the mechanical click) and the tape coming up to speed and electronics coming into full operation. Reproduction was at all times free of clicks and pops, so full marks on these aspects.

One last comment on the transport mechanism and its operation is that we felt the mechanically interlocked push-buttons were too heavy in their operation. The pause button seemed particularly heavy in this respect. It should be possible to lighten the action of all buttons without sacrificing the "positive feel" that a heavy action tends to give.



Above is the disposition of the three heads and dual capstans in the Sony TC-177SD. The dual capstans revolve at slightly different speeds to hold the tape in tension across heads and thus give low wow and flutter, regardless of cassette vagaries.

Two wow and flutter performance ratings are given: 0.07pc RMS (NAB) or 0.2pc (DIN). We made the measurement according to the DIN standard and were able to verify the rating. Readers will note that 0.2pc DIN is low, but not the lowest wow and flutter rating we have reported in these pages. However, the TC-177SD appears to give this low figure consistently, regardless of the cassette.

Fast-forward and rewind times for a C60 cassette are 78 seconds which is about average for decks these days.

Since the machine caters for three different tape types, we elected to test it for all these types. Hence, in the following tests we used TDK ED (a high performance ferric), BASF chromium dioxide and Sony ferri-chrome. In each case, we used the bias and equalisation settings recommended in the well-written manual.

On TDK ED tape, frequency response at minus 20dB below 0VU checked out at between plus 0.5dB and minus 3dB from 20Hz to 12kHz with a rapid taper beyond that. On BASF Cr02 tape, frequency response was plus or minus 3dB between 20Hz and 15kHz.

With Sony ferri-chrome tape, the response had a rather different characteristic to the above two tapes. To restate the situation, with TDK ED the response was very flat up to 12kHz but little beyond that; with BASF Cr02, the response was less smooth but extended up to 15kHz. In contrast, with Sony ferri-chrome the response was flat within plus zero and minus 3dB up to 5kHz and then sloped gently to 20kHz where it was 8dB down. So overall, within 8dB the ferri-chrome tape has the widest bandwidth.

Thus, using ferri-chrome the TC-177SD has the widest bandwidth of any cassette deck we have tested to date.

With each tape, we found a slight but audible degradation in frequency response when Dolby was used. This degradation was between 3dB and 5dB at 12kHz, depending on the tape used. We at first thought that this might be due to incorrect setting of the Dolby levels but a quick check showed that they were very close to the mark.

On the other hand, perhaps there is a chance that the Dolby levels were incorrect as set by the meters, since the meters were reading about 2dB high for recording signals. Time did not permit us to check this possibility. Nevertheless, it does reinforce our experience that use of Dolby noise reduction generally causes some degradation of the bandwidth in most cassette decks.

Signal-to-noise ratio was 51dB unweighted for each tape, using the signal level 60mV minimum input for 0VU. With Dolby switched in, there was the usual reduction in hiss but no reduction in the unweighted noise figure. This indicates, and was borne out on the oscilloscope, that most of the residual noise was of a low frequency nature and hence largely inaudible.

Harmonic distortion was commendably low. The lowest measurement we made was 1.3 pc at 1kHz at 0dB which was equal to the manufacturer's claim.

Actual recordings made from disc sounded very good with only a slight degradation when compared to the sound of the discs. For best results with material having a fairly modest dynamic range we found that Dolby should be switched out. Here, the noticeable degradation in the "highs" was judged to be not worth the small reduction in hiss afforded by Dolby. On the other hand, with classical music which has a larger dynamic range, the use of Dolby gives a beneficial reduction in hiss which most people will judge worthwhile.

In all, the Sony TC-177SD is a well-built machine with an interesting and careful selection of features which will be useful to most potential users. At $898 suggested retail price, it is dear by any standards but this is in the range of other three-head machines on the Australian market.

Further information on the Sony TC-177SD three-head dual capstan stereo cassette deck can be obtained from hifi retailers or from the Australian distributors of Sony products, Sony Kemtron Pty Ltd, 469-475 Kent Street, Sydney, NSW, 2000. (L.D.S.)

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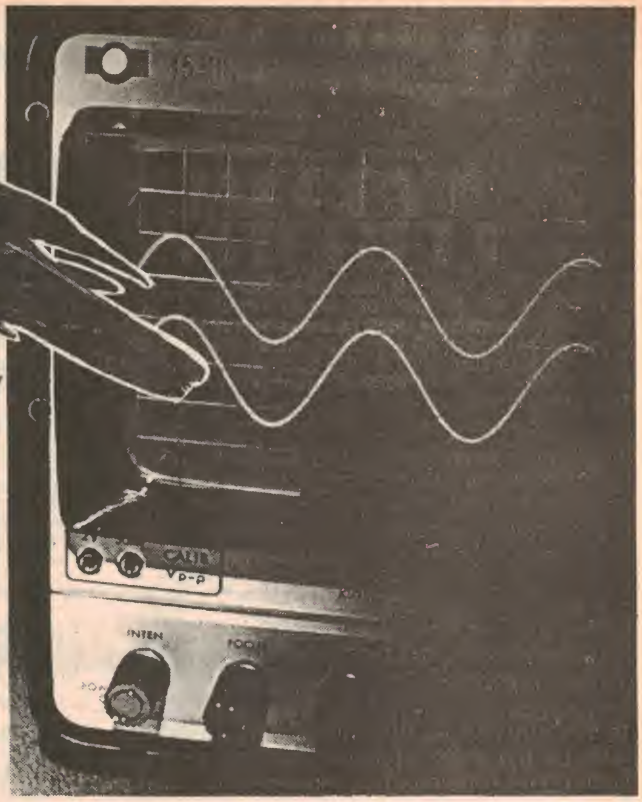

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3" 5 MHz 537 OSCILLOSCOPE

Vertical. Deflection Sensitivity: Better than 10mV/DIV. Bandwidth: DC (AC : 2 Hz) to 5 MHz. Input Impedance: 1MΩ parallel capacitance 36pF. Direct Deflection Terminal. Sensitivity: Better than 10Vp-p/DIV; 100 MHz (Response Frequency). **Horizontal.** Sweep Frequency: 10 Hz to 100 KHz and TV-H. Synchronization: Internal (+ & −), External. **External Horizontal.** Sensitivity: Better than 200mV/DIV. Bandwidth: 2 Hz-400 KHz. Input Impedance: 200KΩ parallel capacitance 25pF. Dimensions: 200W x 155H x 340Dmm. Net Weight: 4.5 kg approx. CRT: 3".

For the full details and a demonstration contact:

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JM/179-74

An inexpensive AM-FM/stereo tuner

The commencement of FM/stereo broadcasting in Sydney has thrown a new emphasis on radio as a source of high quality programs. As a result, many enthusiasts will be interested in a new low-cost AM-FM/stereo tuner currently being marketed by Dick Smith Electronics.

The tuner is neat and compact, measuring 236mm(W) x 83mm(H) x 155mm(D). With a wood-grain finish in the range darker-teak to walnut, the cabinet should merge well with most existing hifi installations.

For an all-up retail price of $65, one would not expect elaborate circuitry, competing with units at three times the price and more. However, an examination of the unit indicates that a lot of thought has gone into its design to ensure uniformity and ease of production and, in this respect, it can be considered as being very well engineered.

For the record, it uses 10 transistors and 14 diodes.

The tuner, as supplied for review, carried the name "Arrow" on the escutcheon, although the instruction leaflet packaged with it uses the name "Echo Sound" model ERC-724. We understand that tuners marketed in this country will carry the latter designation.

One aspect of the design that is immediately obvious is that the tuner is built around a miniature solid dielectric 4-gang capacitor, two sections for AM broadcast, and two section for VHF FM. Here it has the advantage of being driven by a fairly generous cord and slider dial mechanism and the tuning is suprisingly smooth, with a good vernier action.

Tracing through the circuit, input for the VHF FM section assumes the use of either a 300-ohm balanced aerial or a 75-ohm unbalanced system. The signal passes directly to a bipolar transistor through a broadband, fixed tuned transformer. The one gang section available for RF preselection serves a tuned circuit ahead of another bipolar transistor serving as a self-oscillating mixer, both these stages in a common-base configuration.

A shunt diode, biased from the discriminator, provides automatic frequency control (AFC).

Three stages of IF amplification at 10.7MHz precede the discriminator, which uses ordinary diodes in a conventional circuit. This is followed by a single audio stage for FM mono. Miniature slug-tuned IF transformers are used throughout.

For FM/stereo, the signal is diverted to a very simple decoder using two bipolar transistors and four diodes, with a third transistor to activate the "stereo" signal lamp. The circuitry includes de-emphasis capacitors but has no other provision to obviate supersonic components.

Specifications for the FM section are as follows: Frequency range, 88-108MHz; signal/noise ratio 60dB; image rejection 32dB; harmonic distortion 1%; output voltage 600mV; AFC plus and minus 300kHz; stereo separation 35dB.

The AM tuner is very simple indeed, with a self-oscillating mixer fed from an in-built ferrite rod antenna. There are two IF stages at 455kHz, one AGC controlled, and a conventional diode detector.

Specifications for the AM section are: frequency range 535-1605kHz; signal/noise ratio 35dB; image rejection 35dB; harmonic disortion 3%; output voltage 200mV.

An interesting aspect of the circuit is that the IF stages are common to both modes, with 10.7MHz and 455 kHz IF transformers wired in series.

The AM/FM/stereo switching applies voltages as required to those parts of the circuit which are not common, and selects the appropriate output.

The tuner has its own in-built power supply, so that only signal leads are involved in connecting it to the main amplifier. The output in all modes is of the appropriate order for the "Radio" input of typical hifi amplifiers.

Tested in a typical Sydney suburban location, the tuner gave a good account of itself on both the FM music station 2MBS/FM and all local AM transmitters —this with a random length of wire on one FM aerial terminal, and the in-built ferrite loop for AM. It was simply a matter of connecting the tuner to the amplifier with a couple of standard shielded leads and then taking one's pick of all the expected signals.

However, critical tuning across the FM band brought to light a number of carriers, some with TV sound, some with obvious TV picture modulation. In this respect it was generally similar to the behaviour of portable receivers with FM facilities.

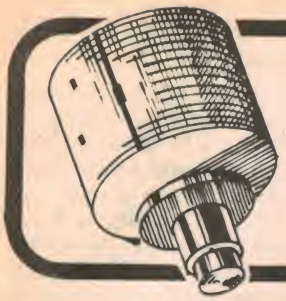
While some TV stations are currently operating within the range 88-108 MHz, others can break through as images or by beating with local oscillator harmonics, where RF preselection is limited. More than that, the presence of 50Hz frame buzz on TV carriers is an indication that AM (therefore noise) rejection in the receiver is not complete.

In practice, it is difficult to predict the behaviour of such FM tuners in different localities or in longer term, as more FM stations are brought into service. If a desired FM transmission happens to fall very close on the receiver dial to a spurious signal, the FM signal may well be blanketed or otherwise compromised.

In an expensive tuner, limited RF preselection and limited AM rejection would provide an obvious basis for criticism—but this is not an expensive tuner. By all other standards, at $65 nett, it is very good value indeed.

To an enthusiast with a thousand dollar system, it would probably be inappropriate to regard the Echo Sound model ERC-724 tuner as a long-term investment, though it would certainly fill an immediate need.

It's obvious role is with modest—but still good—systems which lack radio facilities, This $65 tuner will bring them a normal AM radio voice, with FM and FM/stereo coverage for good measure. Available from Dick Smith Electronics, 160-162 Pacific Highway, Gore Hill, N.S.W. 2065. Pack and postage $3.00 extra. (W.N.W.)



News Highlights

Smart CRT terminal is microprocessor-controlled

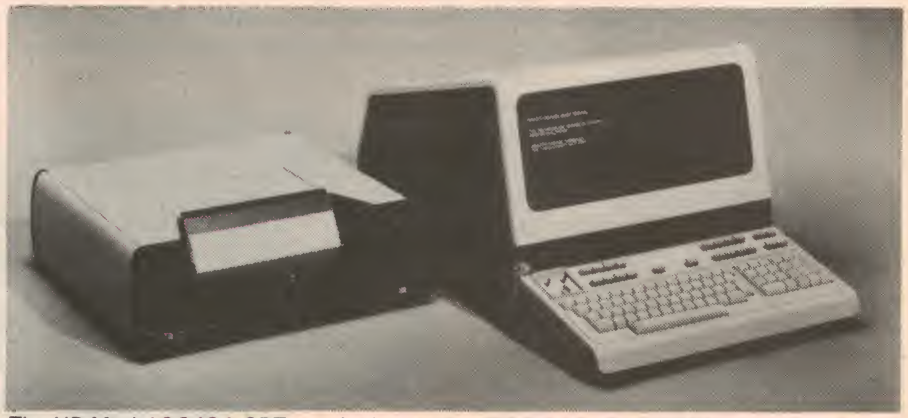
The first in a series of new microprocessor controlled CRT terminals was unveiled in Australia at a recent seminar held by Mr Malcolm Kerr, Data System Marketing Manager, Intercontinental Sales Region, Hewlett Packard. Designated the Model 2640A CRT terminal, the unit is designed for a wide range of applications, including: data entry and preparation, information display and editing, interactive programing, data communications, and time sharing operations.

Microprocessing combined with up to 8,192 bytes of a 4k RAM dynamically allocated memory has resulted in a terminal with many complex features at low cost. The "smart" memory provides efficient storage, as spaces to the right of the last character typed on a line are not stored. Consequently, the basic 2640A terminal equipped with 1,024 characters of display memory can store from 8 to 50 lines, dependent on line length. Memory options of 2,048 and 4096 bytes allow the memory to be expanded to 8,192 bytes, giving over 400 lines of memory storage. This data can be viewed 24 lines at a time by scrolling.

Perhaps the most important feature of the HP Model 2640A is its full off-line editing capability. The terminal's microprocessor manages memory allocation, data communications, keyboard scanning and display control. Data corrections such as character and line insertions and deletions may be carried out at any stage of data entry, the microprocessor automatically sorting the program for transmission to the central processing unit (CPU) and for display purposes. This latter feature makes the unit particularly suitable for time sharing applications as it obviates the need for program editing time in the CPU.

The keyboard is detachable from the unit, and may be operated at a location remote to the display screen. Asynchronous data transmission of ASCII characters is RS-232C compatible at selectable rates up to 2,400 baud.

In addition to the standard Roman fount, mathematical and line drawing character sets, including sub and super scripts and Greek characters, are available. Up to four 128-character sets may be included concurrently in the terminal, and adjacent characters on the display may be selected from any of these four character sets. Additional character sets, such as Japanese Katakana, are planned.



The HP Model 2640A CRT terminal together with the optional 9866A Line Printer.

Additional options include underline, inverse video, blinking, and half brightness display modes. These display modes are intended to increase clarity and to enhance certain portions of input data where desired. Control codes for character sets and display enhancement codes do not occupy positions on the screen.

The display itself is generatd on a 5 x 10inch rectangular screen providing a 1,920 character capacity in 24 lines of 80 characters per line. The characters are formed by a 7 x 9 dot matrix generated by in a 9 x 15 character cell, providing high resolution. Resolution is further enhanced by dot shifting for precise character definition, and by the use of the enlarged character cell for wide character and line separation, underlining, line descenders, and inverse video.

The Model 2640A can be equipped with up to 14 powered slots to accommodate additional options, memory or peripheral interfaces. Currently available from Hewlett Packard is a Duplex Register to connect the Model 9866A Line Printer to the new CRT terminal. Hard copy is printed out at 240 lines per minute.

The Model 2640A CRT Terminal with 1k bytes of memory is priced at $3203 (duty paid) for unit quantities. Additional memory modules with 2k characters and 4k characters are available for $267 and $401 respectively.

For further information contact Hewlett Packard Australia Pty Ltd, 31-41 Joseph St Blackburn, Victoria 3130.

British machine takes automatic fingerprints

A new machine for taking first-class fingerprints automatically has been designed and built by Britain's Home Office and the London College of Printing. It has been developed to overcome the common faults in manual fingerprinting of too much or too little ink, resulting in a blurred print or one with gaps from which neither the automatic reader nor the fingerprint technician can extract satisfactory information.

The machine produces pre-inked strips comprising two flexible membranes sandwiching a uniform ink layer three micrometres thick. One of the membranes is simply peeled off and the strip is ready for use. The ink does not dry during storage and has a shelf life of two years, but does not dry when the membrane is removed and the impression is taken. The London College of Printing has produced several thousand strips during operational trials which have proved highly successful.

Development work is in progress on more sophisticated versions of the machine which will rapidly transfer the impression automatically to the standard fingerprint record card.

Bowmar Corp sues Texas Instruments

The first major antitrust suit in the calculator business has the financially troubled Bowmar Corporation pitted against its supplier and competitor Texas Instruments. Bowmar is charging "deceitful misrepresentation, conversion of trade secrets and fraudulent patent practices," and wants $240 million compensation.

In a suit filed in the Indianapolis District Court, Bowmar claims that it contracted with Texas Instruments in 1970 to build a calculator chip. In the process Bowmar divulged technical secrets to Texas Instruments on the basis of that company's "volunteered information" that it didn't intend to enter into the production of pocket calculators. In 1972, Texas Instruments did just that, Bowmar alleges, using knowledge and information gained from Bowmar.

Texas Instruments is further accused of cutting back supplies of components to Bowmar and other companies in favour of building its own calculator business, thereby attempting to monopolise the calculator trade; buying up competitive supplier's components to keep them from other calculator manufacturers; selling calculators at "predatory prices" below cost to injure competitors; and refusing to sell certain advanced design components to Bowmar and others since 1973.

Voice warning system developed for jetliners

A new system that gives voice warnings of possible technical faults and operational errors may soon be in use in modern jetliners.

The new system, which uses a digitised vocabulary of 25 words, is being developed by McDonnell Douglas Electronics Company, St Peters, Missouri. It is possible that the first units will be installed aboard the DC-10 jets manufactured by the parent company, McDonnell Douglas Corporation.

Audio-visual signals are already used to alert pilots to problems such as reduced cabin pressure or engine fires, but the sounds are produced by various bells, tones and buzzers.

The voice backup is intended to reduce the time for interpreting the malfunction signals. It is a retrofit package to be added to the tone warning system—called Central Aural Warning System (CAWS)—which is already flying aboard the DC-10s. The messages are advisories, not commands. For example, if the plane is equipped with a ground proximity warning system, the message might be "too low" rather than "pull up". Warnings include "over-speed", and "landing gear". There are also messages for engine fires and take off warnings like "slats", "flaps", "spoiler", and "stabilizer".

FCC gives go-ahead for Dolby FM

Music and other program material can now be broadcast over FM radio in the US with much less background noise, thanks to a decision handed down by the Federal Communications Commission (FCC).

The FCC has issued a public notice that FM radio stations may now broadcast using the Dolby noise-reduction technique. This technique produces a cleaner FM signal and effectively increases the area of coverage without requiring additional transmitter power.

For the past three years, Dolby Laboratories and Signetics Corporation have been collaborating on a microcircuit version of the Dolby noise reduction system. In 1972, Signetics put the integrated circuit into mass production, which reduced the cost of using the technique from hundreds of dollars down to tens of dollars. The circuit, known as the model "NE545", is now being incorporated into major brands of cassette tape recording decks.

So far, seven FM stations have begun using the Dolby technique in their broadcasts. They are K101 in San Francisco, California; WAKR in Akron, Ohio; WCRB in Boston, Massachusetts; WDCS in Portland, Maine; WFMT in Chicago, Illinois; and WQXR in New York City.

Dee Aarhus of Signetics displays one of the new Dolbyised FM receivers.

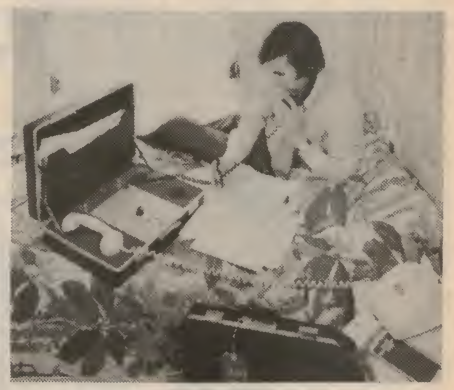
Two manufacturers of FM receivers, Marantz and Akai, are already producing FM receivers that contain the Signetics-built Dolby "B" processor circuit.

New scrambling device ups telephone security

When confidential information is passed by telephone, there is always a risk—accidental or otherwise—of the conversation being overheard.

A new British device, known as the "Privateer", overcomes this problem by scrambling the conversation for transmission and unscrambling it at the receiving end. Only those using the device can hear what is actually being said.

Available in either fixed or briefcase style, the unit is compact, easily installed, and can be used without interference from existing equipment. The portable version pictured here contains all the necessary scrambling circuitry, a simple two switch control console, and a telephone handset.



Conversation passes through the scrambling circuitry to a regular telephone handset which is positioned in cushioned sockets in the briefcase. The unit is powered from readily available dry batteries.

NASA data recorder has no moving parts

A solid state NASA-developed data recorder with no moving parts may replace magnetic tape recorders aboard spacecraft in the 1980s. Other possible applications include use as aircraft flight data recorders and as electronic control systems in mass transit systems. Experimental models of the device have already been pronounced successful.

These recorders offer high reliability—a major advantage over magnetic tape recorders, Charles E. Pontious of the Office of Aeronautics and Space Technology said. Elimination of moving mechanical parts results in high reliability. Failure of moving parts accounts for 70 percent of magnetic tape recorder malfunctions aboard spacecraft.

Technology for such a recorder is based upon the use of very small magnetic domains termed "bubbles". These magnetic bubbles exist in specially prepared garnet chips. By applying a thin film of magnetic material in appropriate patterns over the chips, these bubbles can be moved and controlled to perform logic functions.

The present experimental model has a 60-thousand bit data storage capacity. The overall objective of the present research program is to provide a solid state data storage system with a 100-million bit capacity by 1978.

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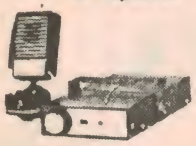

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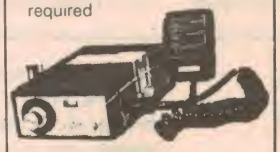

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NEWS HIGHLIGHTS

Automatic pilot wins inventors award

A radio engineer who combined love for sailing and expertise at electronics to invent a simple and economic automatic pilot suitable for all types of craft has won $500 in the John Lysaght Inventors' Award competition.

Mr Richard Chapman, radio manufacturer of Lane Cove, is one of ten inventors in all mainland states who have shared the 1974 $5,000 award.

Mr Chapman believes his automatic pilot is the only one with its own memory system. There are other pilots which will perform a similar function, but they are more expensive, costing about $2,000. Mr Chapman hopes to manufacture and market his for less than $1,000.

The pilot is a quite ingenious device in which light-sensing cells are set opposite each other over a magnetic compass card into which has been cut a crescent-shaped slot. Light shines from beneath the compass, also specially made by Mr Chapman, through the crescent-shaped aperture to place an equal charge on each cell when the boat is on course.

Should the boat diverge from course, the amount of light reaching each of the two cells is unequal and hence their charge is unequal. This activates the steering mechanism to bring the boat back on course. A third cell is also placed above the compass card, and when the boat is on course has no light on it. This cell, combined with the others, activates the memory circuit to ensure that the pilot always steers the boat to any new course by the shortest arc. A new course may be set simply by turning a knob.

Geostationary satellite for STAR consortium

Work is currently in progress on the Geostationary Orbital Satellite (GEOS) development 'model' at the Electronic and Space Systems Group of the British Aircraft Corporation in Bristol, south-west England. GEOS is being developed by the Satellites for Technology Application and Research (STAR) consortium of companies for the European Space Research Organisation under the prime contractorship of BAC. It will be Europe's first geostationary satellite.

The development model brings together for the first time the many sub-systems from the STAR consortium, together with the on-board experiment apparatus from the nine scientific groups in this multinational program. Its purpose is to resolve problems of functioning and electronic compatibility in advance of building the satellite flight model. GEOS is due for launch in the autumn of 1976 and will probe the nature of the electric, magnetic and particle fields in the Earth's magnetosphere.

In operation, data from the satellite's attitude in orbit is derived from on-board sensors and transmitted to the ground control station. Computed instructions sent to the satellite command its attitude and orbit control sub-system to release controlled bursts of hydrazine through small jet thrusters to manoeuvre the satellite in attitude and position.

Computerised VHF system for Great Lakes shipping

A powerful, compact Varian computer will direct automated ship-to-shore communication in an advanced radiotelephone system that soon will span the Great Lakes.

The new VHF system is being developed by Lorain Electronics, Lorain, Ohio, under contract to the US Maritime Administration. It will be far less susceptible to interference than is the existing radiotelephone network.

Besides handling conventional ship-to-shore calls between commercial vessels and their home offices, the system will perform a variety of automated communications functions. For example, it will poll subscribing ships at regular intervals, gathering navigational data, weather information, and messages that have been loaded into a shipboard "status-monitor unit".

Initially, the new Great Lakes Automated VHF Radiotelephone System will have six shore stations, and will cover all or part of three Lakes: Superior, Michigan and Erie. Later, it will be expanded to cover all five Lakes, using 14 stations.

The new VHF system's shore stations will be unattended. Each station will relay traffic over two different lines: a dial-call line from the local telephone company, and a leased line between the shore station and the system's central, attended station at Lorain, where the computer will be housed.

The dial-call will carry individual calls between a telephone subscriber (such as a shipping company) and a vessel under way. The subscriber will dial an appropriate number, and the shore station will automatically establish a radio-frequency link to the ship that he wants to contact.

The computer's most important tasks will be to gather information automatically from ships moving on the Great Lakes, and to broadcast weather information regularly to subscribing vessels.

The master of a ship equipped with a status-monitor unit will be able to load the unit with such information as his position, course and speed, local weather conditions, and estimated time of arrival, along with coded word messages for his owner. The computer will poll all such ships every few hours, withdraw this information from the unit, and place it in storage.

Authorized callers—the ship's owners, and the National Weather Service (for weather data only)—will be able to get the stored information, on demand, by dialling the central station in Lorain.

By keeping track of each ship's progress, the computer will know which shore station to use in contacting each ship at each polling. If a ship can't be reached through the indicated station (or probable alternative stations), the operator at the Lorain station will be alerted.

—George E. Toles

BSR HAVE MADE

BSR 810 Automatic/Manual Transcription Turntable

1

The top of the BSR range and suitable for the most sophisticated systems whether professional or for the connoisseur. Operated by a pre-programmed sequential cam system for beautifully smooth operation. A low mass transcription arm floats in a concentric gimbal arm mount, virtually eliminating tracking error. It has precise zero balance adjustment over the full range of cartridge and stylus masses. The die-cast, dynamically balanced 6¾lb. turntable is driven by a high torque synchronous 4-pole motor. The automatic change is worked on an umbrella type centre spindle to save wear on your records. The 810 also features variable pitch control, dual range anti-skate, stylus position gauge, stylus brush, automatic tone arm lock, slide-in cartridge carrier and viscous damped cue and pause with exclusive friction clutch. The unit is complete with an ADC K5E magnetic cartridge with elliptical diamond stylus and is now mounted in a specially selected quarter cut teak veneer plinth with a smoke tinted perspex cover. **$271.18***

BSR HT70 Three Speed Single Play Turntable.

2

This is a high precision luxury player ideal for that select group of enthusiasts who insist on manual operation. It features a deep rim, die-cast turntable weighing 4½ lb, engineered to provide a perfect tracking angle, a rotating stub spindle which avoids centre hole wear on your records, and a fully synchronous dynamically balanced 4-pole motor to lock on to the frequency and compensate for fluctuations in the mains voltage. It features the BSR anti-skate force control and a low mass tone arm supported on ball race bearings, fitted with an ADC K7E cartridge. A pitch control is provided enabling the turntable speed to be adjusted by ± 3%. The unit is mounted in a specially selected quarter cut teak veneer plinth with smoke tinted dust cover. **$137.45***

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(Now we distribute famous ADC Cartridges too!)

3

BSR 710 Automatic/Manual Transcription Turntable

A slightly more economic version of BSR's fabulous 810. The specifications are similar except the 710 has a low mass aluminium arm suspended in a ball-bearing race, balanced by resiliently mounted decoupled counterweight, and fitted with an ADC K7E magnetic cartridge with elliptical diamond stylus. **$251.71***

BSR 660 Two Speed Magnetic Automatic/Manual Turntable

The finest model in BSR's Professional Series. Includes specially selected quarter cut teak veneer plinth with smoke tinted dustcover, ADC K7E elliptical diamond stylus cartridge. A die-cast 4 lb. platter coupled to a heavy-duty synchronous motor insures low wow, flutter, and rumble, and unvarying speed regardless of the number of records on the platter or variations in electric voltage. A pitch control is provided, enabling the turntable speed to be adjusted by ± 3%. The tone arm is a low-mass aluminium design, suspended on low-friction needle and ball bearings, and equipped with an adjustable counter-weight, dual-range, anti-skate control, slide-in cartridge head. An automatic locking device prevents accidental arm movement that could damage the stylus or records, and a viscous damped cue/pause control is fitted. **$136.46***

4

5

BSR 560 Two Speed Magnetic Automatic/Manual Turntable.

The best performing turntable in its price class. The 560 is well suited to any quality audio system. A synchronous motor insures low wow, flutter, and rumble, and unvarying speed regardless of the number of records on the platter or variations in electric voltage. The turntable weighs 3½ lbs. The tone arm system is the same used in the 660, complete with a viscous damped cue/pause control. It is mounted in a specially selected quarter cut teak veneer plinth with smoke tinted dust cover, and ADC K8E cartridge and elliptical diamond stylus. **$123.82***

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Computerised crime file aids Canadian Mounties

Computerised dossier systems capable of storing and disseminating vast amounts of information quickly and efficiently are playing an important role in crime detection and prevention in many countries. Here we examine one such highly successful system as operated by the Royal Canadian Mounted Police, discuss its security and privacy safeguards, and give examples of computer "arrests."

by PHILIP SMITH

Perhaps it was the sixth sense good policemen are supposed to have, but there was something about the car parked on the side of the road that didn't look quite right to Lionel Ellis, an Ontario Provincial Police constable on patrol near Matheson, in Northern Ontario.

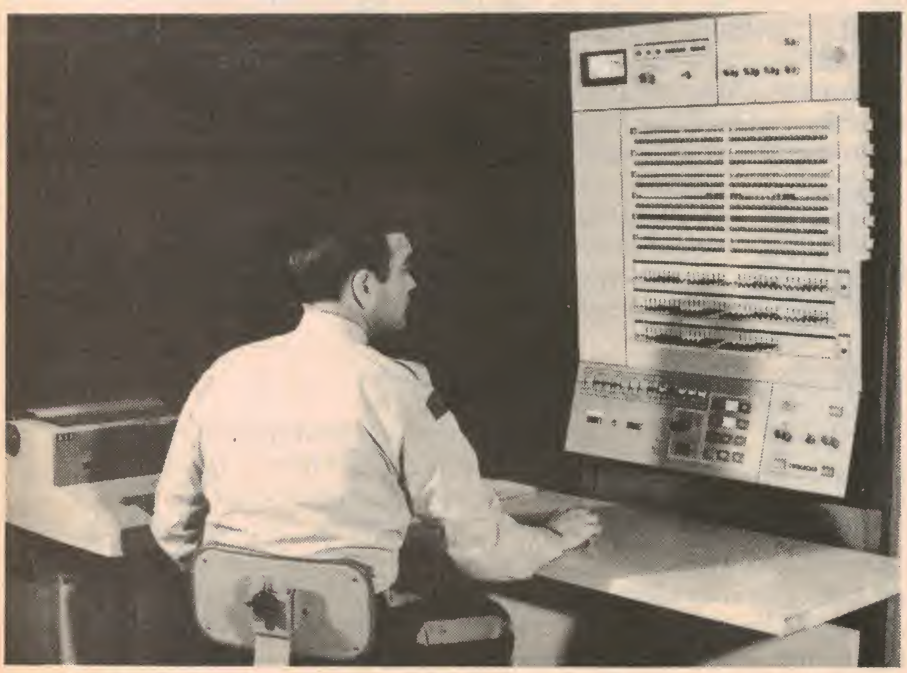
First of all, the way it was tucked among the trees you could hardly see it from the highway, as if its driver, now sleeping soundly behind the wheel, had tried to hide it.

While there are plenty of American hunters around Matheson in the moose season—it was November, 1972—they don't usually travel alone. This car had California plates. California seemed a long way from Matheson, even for a moose-hunter.

Here, thought Ellis, was a good opportunity to check out that new CPIC system they were running in Ottawa. He radioed the car's licence number into his detachment—and within seconds, back came the news that the car had been stolen from Riverside, California. The man presumed to be driving it had a long police record and was currently wanted for murder.

Forewarned is fore-armed, and Ellis waited for another car to join him before he woke the driver and arrested him. Just five minutes had elapsed since he had become suspicious and queried CPIC—and once again, the computer had got its man. Returned to California, he pleaded guilty to first-degree murder and was sentenced to life imprisonment.

The computer is the heart of CPIC—the Canadian Police Information Centre—a nation-wide automated communications system set up by the Royal Canadian Mounted Police over two years ago. Plugged into it by almost 700 terminals from Whitehorse to Labrador City, police forces across the country now have at their fingertips—in as little as 10 seconds—information for which they used to have to wait hours, or days.



Installed in regional offices throughout Canada, computer terminals such as these give police officers "instant" access to the CPIC computer in Ottawa.

Storing up or giving out crime information at the rate of 120 words a second, the computer handles 230,000 queries a week from police forces on the network—the provincial police in Ontario and Quebec, RCMP detachments in the other provinces, and all major city police forces. From the recesses of its capacious memory it can give the cop on the beat answers to questions there was no point even asking before.

The Mounties established a central repository for police information in Ottawa in 1910. By 1963 its files were bulging so badly that searching them could take days. Since it's no use asking a policeman to chase a dragster in a Model-T Ford, a study team was set up to revamp the system.

In the space age, the obvious solution was a computer and the model chosen was the IBM 360/65, as used by businesses and universities. To man it, the Mounties raided computer establishments: two-thirds of the CPIC staff of 255 are civilians sworn into the force for the job.

It was decided to launch the system by programming all existing records on stolen vehicles into the computer, and after policemen had been trained to operate the typewriter-like terminals, which are silent enough to be housed in police-station radio rooms, the system went "on line" at noon on July 1, 1972.

An hour and a half later, an Ontario Provincial Police patrolman at Burlington found a burned-out and abandoned truck. Its licence number was punched into the computer from the station and it was quickly identified as having been stolen from Hagersville, 30 miles away. While there was no arrest, at least there was no more need to mount a search for the truck. That was "hit" No. 1.

Next day, there was a more impressive demonstration of the system's value. The driver of a car which caused an accident at Oakville leaped out and fled, but a witness was able to describe him to police.

A check of the computer proved "negative"—the car was not entered as stolen.

Later that day, a man reported to Hamilton city police that someone had stolen his car. Hamilton entered its licence number in the records by feeding it into the computer. And immediately the computer "recalled" that Oakville police had been asking about that same car four hours earlier.

A Hamilton police officer called Oakville—each computer response ends by ordering the recipient to check with the originator of the record—and as he noted down the description of the driver who had left the scene he realized it fitted the car owner, who was still standing at the desk. Faced with this fact under questioning, the man admitted his guilt.

This "no-hit" feature of the computer, a built-in "memory" for unproductive inquiries which lasts 72 hours, is invaluable in police work. In October, 1972, an RCMP patrolman near Regina became suspicious of a truck he was following. He stopped it but everything seemed to be in order and so, in the time-honoured police phrase, "the vehicle was allowed to proceed".

Nevertheless, the patrolman remained suspicious and radioed in to his detachment. The computer was queried and the answer was "negative".

But a few minutes later the Regina city police entered the truck as stolen. The computer promptly followed up on its first response to the RCMP and the patrolman was contacted by radio so quickly that he could still see the truck ahead of him on the highway. He arrested its occupents and they eventually confessed to more than 20 break-ins.

As the system demonstrated its usefulness and more forces began to take advantage of it, a second category of information was added to the computer: the names of all those people "wanted or missing"—those for whom a warrant has been issued; those charged with an offence under the criminal code; those out on bail or parole; and those reported missing.

Once again, the value of the new investigational tool was obvious. In September last year, for instance, an OPP constable patrolling Highway 401 near Whitby, east of Toronto, spotted a man drinking beer while driving. He pulled him over and as a routine precaution radioed his name to the officer manning the computer terminal.

The car had Arizona licence plates, and while there is no link between the CPIC computer and its FBI counterpart, the RCMP does have a terminal by which it can request information from the FBI centre in Washington. The man's name was punched into the terminal—and it was found he was wanted for armed robbery in Detroit and Phoenix, Arizona.

The patrolmen searched his car and found a loaded revolver and 50 rounds of ammunition. And instead of a mundane offence under the liquor control act the

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I don't know what part of Oriental philosophy or pride it is that makes them want to write and produce their own leaflets, instruction books and so on, but it sure provides us with some laughs from time to time.
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Expense-account poked his head around my door the other day (he's got that sort of head) and dumped some leaflets and clippings onto my desk.
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Well, if there's one thing I know about L&G, it's this — you can write about it until you're blue in the face and anywhere else it might count, but it still won't tell you what you want to know. It might with other makes, but not with L&G.
Baby, you gotta see it. You gotta hear it. I mean, are you really going to believe someone who promises "listening pleasure for all ages, from innovative youth to the discriminating fuddy-dud."? Are you? Then there's the lovely bit on the back page of the colour brochure.
"L&G colours and designs are aimed at a total involvement in sensual experience, not just your ear."
I think I know what they mean. But I'm also afraid that I know what they're getting at.
In all, the L&G colour brochure is priceless for its incredible English. It's a mixture of the very worst avant-garde verbosity, with a sprinkling of colloquialisms, and some desperate try-hard phrasing that doesn't fit anywhere. If you can get a copy, lay your hands on it fast. It's a collector's piece.
NOW — having got that off my clotheshne, let me reiterate: With L&G, to know what it's all about, you have to see it and hear it. See it, because it's so terrifically different from anything else and (depending on yourself) tremendously exciting.
Hear it, because that's where it's all at.
That's what you're buying. The sound.

Personally, I can't separate the beaut sound from the great colours. Who ever decided that Hi-Fi equipment should all be brown and black, anyway?
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How does it compare? A friend of mine described L&G thusly —
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Which is as neat a way of putting it as I have yet heard. L&G. It's going to be the big name in Hi-Fi this year. Don't say I didn't tell you.

. . . . . .

Got this lovely present through the post (it was ten cents short on postage) from my earnest admirer, Alfred E. Neumen, of Gore Hill. I assume it was from him anyway, it was all written in pencil. Anyhow, I've given poor Alf a pretty rough trot, what with not answering his phone messages, or reply-paid telegrams, or invitations written on matchbook covers, so I'd like to thank him for being so nice about it all, and sending me such a nice gift. It was one of those optical peephole devices for fitting in doors so you can see who's there. However, Alf, your instructions weren't entirely accurate. Firstly, the device should be mounted at eye level — not chest level. Secondly, the viewing end should be on the inside of the door, not the outside. I'll leave a biscuit out for such a good try, anyway. Next month — a very special surprise for you.

Apologies department: to the guys at the APO who weren't mentioned last month when OTC was; and to the unsung electronic and Hi-Fi heroes at some of our larger high schools. Don't rip your magazine so you can put our ad on your noticeboard — let me know who you are and where you are, (write to me at Head Office) and I'll try and convince expense-account to send you a free ad-sheet each month, OK?
Keep your iron hot,

Kit

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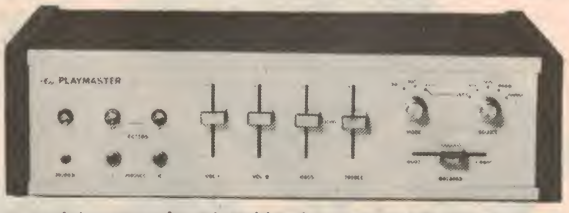

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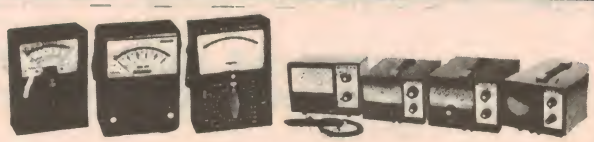

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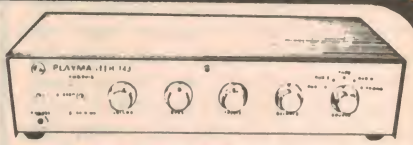
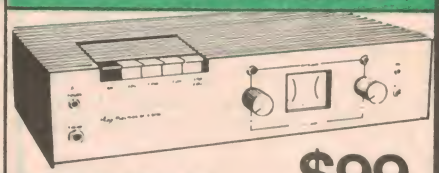


PLAYMASTER 143 AMP KIT

EA's latest (Sep. '74). Virtually a new and advanced version of the Playmaster 136. Includes stereo phone socket and more flexible quad simulation. 16.5 watts RMS per one channel into 8 ohms. ± 2dB from 20-20kHz. SN ratio better than 60dB. Distortion at typical listening levels 0.4%. Ho-hum. While you-know-who expects you to pay $3 + $79, what is our price? **$75** P&P $2.

Playmaster 141

Supersedes the popular Playmaster 137. Based around Texas Instruments new audio power IC, the SN76023, for which they claim over 10 years life under normal use. 4 watts music power per channel into 8 ohms one channel driven. 40-45 kHz ± 3dB. SN ratio better than -56dB at 3 watts into 8 ohms. A really neat design to build into your own cabinet. P&P $1. Board components only **$16·50**



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man was charged with possession of a restricted weapon and held for extradition to the US.

As CPIC celebrated its second anniversary last July, it had 333,000 "wanted or missing" persons on the computer and 110,000 "stolen vehicles"—a wide category that embraces not only cars, trucks and motor-cycle but stolen licence plates, validation tags, golf carts and even three aircraft. And since it went on line the computer had handled 8.7 million "transactions" in the "wanted or missing" category and 5.5 million inquiries about stolen vehicles.

Some of these inquiries can be complex. For instance, if you see a couple of holdup men escaping in a car but only catch part of its licence number—say the first and last digits—the computer can quickly produce for police a "print-out" of any or all stolen cars which have those digits in those places.

Police are clearly enthusiastic about the new system, but it is too early yet for national statistics to have been prepared to prove its effectiveness—though Statistics Canada has just such a study under way.

"I'm confident that the next print-out of Statistics Canada will show a marked increase in the recovery rate of stolen vehicles," says RCMP Assistant Commissioner A. C. Potter, CPIC director.

The experience of Penticton would appear to be typical. Within 30 days of a CPIC terminal being installed there in January last year, the police had scored 18 "hits" in the "wanted or missing" category, which resulted in 13 "apprehensions", eight of them arrests. Three stolen cars and a snowmobile were recovered with the help of the computer. Twelve arrests were made at other places as a result of information punched into the system by Penticton police.

The computer as an all-seeing and vindictive "Big Brother" is an image that bothers many, and Assistant Commissioner Potter admits he has had "queries" from civil rights groups about the CPIC system.

"But the computer doesn't change anything", he says. "It just makes it quicker for police to get access to records that already exist in some police station somewhere. And if the computer says Philip Smith is wanted, the policeman on the spot still has to make sure you are the Philip Smith wanted. The computer doesn't relieve the policeman of the responsibilities he's always had.

"To me it reflects a lack of understanding of this system and computers generally that these criticisms are being made. This is an in-house system between police forces and the information on the computer is not being disseminated to the public at large."

A communications officer inserts a portable disc pack into the CPIC disk storage unit. Each pack stores 28,000,000 characters of information which can be retrieved at the rate of 200,000 characters per second.

CPIC is a private, "dedicated" system, which means that the computer is not shared with anyone else. And according to officials of CN/CP Telecommunications, which installed it, it is burglar-proof. "An unauthorised terminal couldn't even develop a hand-shaking arrangement with the computer," one of them told me.

Also, the information entered into the computer must follow a set pattern or the computer will reject it. And each force with access to a terminal must adhere to strict rules. For instance, there must be a numbered "case file" opened for anyone entered as "wanted"—and a warrant must have been issued for his arrest. In addition, each case must be followed through and "dead" information—if a wanted man is arrested, for example—must be removed from the computer right away: there are an average of 44,000 "transactions" cancelling or updating information every week.

To ensure the accuracy of the computer record, each force with a terminal is sent a monthly list of its entries which it must "validate" by checking against its own files. And the RCMP, or such provincial authorities as the Ontario Police Commission, carry out continual surprise "audits" to make sure the information on the computer conforms with the case files in police stations.

One of the complaints about the proliferation of computer dossiers is that you never know if your name is on one—and you can never check the information filed about you. Potter chuckled when I mentioned this.

"We'd be grateful if a man came in here to see his record," he said, "because he wouldn't be on there unless he was wanted for something." (The owner's name is not part of the information filed when a vehicle is stolen.)

Potter conceded that there might be more protests about the latest phase of the CPIC system: the filing of criminal histories of anyone convicted of an indictable offence. As CPIC entered its third year of operation, much concerned discussion was going on in police circles about the nature and extent of the information to be filed in this category.

"But this will still be merely an investigational aid," Potter says. "The police will still have to rely on fingerprints for identification—and no one who hasn't been fingerprinted will be on there. If you doubt the accuracy of this system, then you have to doubt the accuracy of the whole police and court system.

"There's no danger in the retention of information; the only danger would be in its dissemination. And our system is more secure than the old one, in which we used the normal surface mail.

"What we are, really, is one great big filing cabinet for police forces across Canada."

Lasers may provide a new standard of length

One of the prime requirements in setting up a standard is that it be capable of being easily and accurately reproduced in space and time. Perhaps one of the most important standards in use today is the standard of length, currently based on a specified number of wavelengths of orange radiation from krypton-86. This article details the research now in progress which is aimed at superceding this standard.

The present definition of the metre, adopted in 1960, is in terms of the wavelength of the orange radiation from a krypton-86 lamp. As shown here, the lamp is enclosed in a liquid nitrogen bath, the radiation emerging from the opening at the lower right.

If they wanted to, scientists could now replace the existing 13-year-old standard of length (a specified number of wavelengths of the orange radiation from krypton-86) by a much more accurate one based on advanced laser technology.

An important first step towards a change in the standard was taken in a report made in October 1973 by the Consultative Committee for the Definition of the Metre (CCDM) to the International Committee of Weights and Measures. In that report the CCDM recommended the adoption of specified 9-digit values for the wavelengths generated by two molecular-absorption-stabilised lasers and for the speed of light. And from the discussions accompanying the report it seems likely that the way is being prepared for a redefinition.

Efforts to improve the standard of length were initiated soon after adoption of the present definition in 1960, and are a good example of the elaborate and painstaking investigations that are characteristic of modern science. In order to see where these efforts have brought us, it will help to look briefly at earlier standards.

The French scientists who framed the original definition of the metre in 1791 seemed to be obsessed by the idea of indestructibility. They felt that a metal rod, as previously used, was too easily damaged to serve as the primary standard. So they chose, instead, the earth itself, defining the metre as 1 ten-millionth of the distance from the north pole to the equator along the meridian through Dunkirk.

A large-scale project was undertaken to measure the quarter meridian and the result was embodied in a metal rod to represent 1 ten-millionth of it. In principle, the length of the rod could be rechecked by another such project, but this was so difficult that a metal rod served for decades as the effective standard. More recent earth measurements have shown that the original measurement of the quarter meridian was in error by 1 part in 5,000.

In 1875, the metric convention, signed by the United States and 17 other countries, adopted as the primary length standard a bar of platinum-iridium, on which were inscribed two lines whose spacing defined the metre. This spacing maintained as nearly as possible the size of the metre then in use. The limiting uncertainty inherent in this standard was believed to be about 1 part in 10 million.

The possibility of an entirely different type of length standard, a wavelength of light, had been suggested as far back as 1827 by the French physicist Babinet. Nothing came of the suggestion until the end of the century when Michelson began making measurements with the interferometer that bears his name. With the interferometer, Michelson could accurately compare light wavelengths with ordinary lengths like measuring rods. He also had available a light beam, the red light from cadmium, that was both sufficiently intense and sufficiently monochromatic for the purpose.

A perfectly monochromatic source, one that radiates a single isolated frequency, and therefore a single wavelength, is a theoretical abstraction and not producible in practice. Every actual source radiates over a range of wavelengths, and the narrower this range — i.e., the narrower the spectral line — the more accurate a length standard it can provide.

By 1905, spectroscopists and atomic physicists were using cadmium radiation as a standard for high-accuracy wavelength comparisons. It was not, however, until 1960 that the platinum-iridium bar was replaced by a wavelength standard for the scientific community as a whole.

This was adopted by the Eleventh General Conference of Weights and Measures, which defined the metre as 1,650,763.73 wavelengths in vacuum of the orange radiation emitted by isolated atoms of krypton-86. The Conference further specified how a krypton lamp was to be constructed and operated in order to provide this same wavelength. Experience has shown that any two krypton lamps, properly constructed and used, will agree within 4 parts in a billion.

Primarily responsible for this high degree of reproducibility was the development of methods for separating pure isotopes, like krypton-86, which radiate particularly narrow spectral lines.

The same year, 1960, also saw the

Meter Bar 27, the US national standard of length from 1893 to 1960 and one of a number of copies of the platinum-iridium prototype metre maintained by the International Bureau of Weights and Measures in Sevres, France.

development of the first gas lasers, which could continuously generate radiation with a much narrower line width. The trouble was that the wavelength of the radiation tended to change because it depended on the dimensions of the laser cavity and other characteristics difficult to hold constant. For the same reason, one could not expect two different lasers, though built to the same specifications, to have the same wavelength.

A solution came in 1967 with the idea of "saturated absorption." This enables one to "lock" the laser wavelength to the absorption line of a gas. A gas that can generate a narrow spectral line will absorb radiation only if it falls within the wavelength range of that same spectral line.

In a laser stabilised by saturated absorption, a transparent cell containing a gas, such as methane, is placed inside the laser cavity. The intensity of the laser beam will then depend on how closely its wavelength matches that of the gas absorption line. A feedback mechanism can be designed to take advantage of this, continually varying, say, the position of one of the laser end mirrors so as to prevent the wavelength from departing more than a very small amount from the maximum absorption wavelength of the gas.

Among the stabilised lasers most studied thus far are those mentioned in the CCDM recommendations: helium-neon lasers stabilised by methane or iodine. The most recent experiments at NBS, dealing with helium-neon lasers stabilised to absorption lines of iodine-129, were carried out by W. G. Schweitzer, Jr., E. G. Kessler, Jr., R. D. Deslattes, H. P. Layer and J. R. Whetstone. At the present stage, it is believed possible to design stabilised lasers of these kinds that are reproducible to 1 part in 10 billion, with a good chance of attaining 1 part in 100 billion. To illustrate their stability, NBS scientists have built methane-stabilised lasers whose frequency, averaged over successive 10-second intervals, varies by less than 1 part in 10,000 billion (1 part in 10 to the 13th).

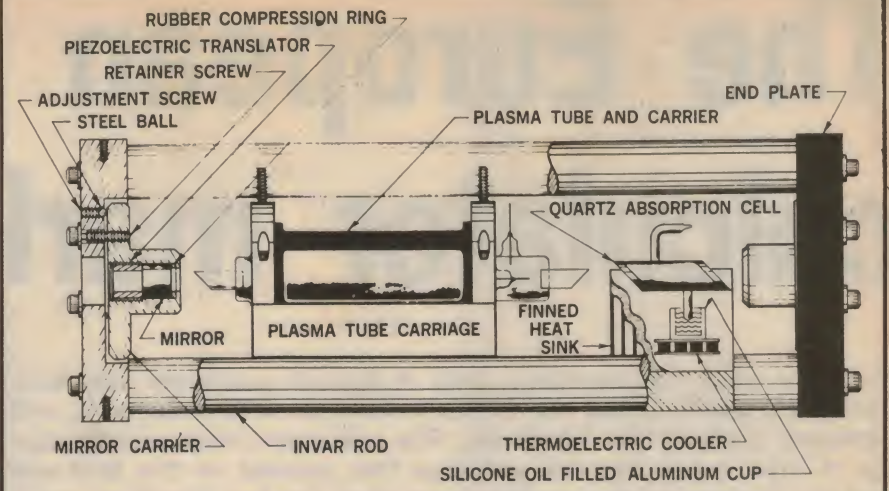
Not only does the wavelength of a certain radiation serve as the standard of length, but the frequency of another radiation (emitted by cesium) is used in defining the second of time.

But what if the same radiation were used for defining both the second and the metre? These definitions would then automatically determine the value of the speed of light. This would be the case because, for any kind of waves, speed equals frequency times wavelength.

In fact, it is now feasible to use any of the radiations mentioned as a basis for both time and length standards, although for various reasons this is not considered practical.

On the other hand, if we assign, by convention, a value to the speed of light (which, in vacuum, is the same for all electromagnetic radiations), then that value together with a radiation-based definition of the second, would fix the unit of length. That is, the metre would be the distance the radiation travels in a specifiable time. Or, the assigned speed of light, together with a wavelength definition of the metre, would fix the length of the second: namely, as the time needed for light to travel a specifiable distance.

What gives these considerations interest is that it recently became possible to make



A cutaway view of the iodine-stabilised laser studied at NBS. A feedback arrangement continuously adjusted the mirror position (via the piezoelectric translator) to lock the laser wavelength to an absorption line of iodine-129 gas contained in the quartz absorption cell.

An ancient standard of length, the royal cubit of Egypt (around 1550BC), made of black granite. The cubit, which means "forearm," was subdivided into two spans, six palms, and 24 digit or finger breadths.

direct measurements of the speed of light with an accuracy comparable to those of the definitions of the metre and the second.

Underlying the increased accuracy of the speed of light are new techniques, pioneered by Javan and co-workers at the Massachusetts Institute of Technology (MIT), for generating exact multiples of a given frequency. This makes it possible to measure a laser frequency (of the order of 100,000 GHz by comparing it with some multiple of a lower frequency; then comparing the latter in the same way with a still smaller frequency; and so on for several steps until an accurately known frequency, usually in the microwave range, is reached.

This method was further developed by scientists of the NBS Boulder laboratories, Kenneth M. Evenson, Joseph S. Wells, F. Russell Petersen, Bruce L. Danielson and Gordon W. Day, who succeeded in 1972 in measuring the frequency of a methane-stabilised laser to 6 parts in 10 to the 10th.

This result was combined with a careful measurement of the wavelength of the same laser, on the basis of the krypton standard, made by Richard L. Barger and John L. Hall, also of NBS. Multiplying the measured frequency and wavelength gave a value for the speed of light accurate to 4 parts in 10 to the 9th. This value, which is consistent with other recent determinations, is the one recommended by the CCDM.

In view of the advances in stabilised lasers, in laser frequency measurements and in the determination of the speed of light, it is now clearly possible to redefine the metre so that it can be more accurately reproduced in the laboratory. One possibility is to redefine the metre in terms of the wavelength of one of the stabilised lasers. The other is to take the metre as the distance travelled by electromagnetic waves in vacuum during a specified fraction of a second, the fraction being the reciprocal of the value adopted for the speed of light.

The two alternatives correspond, respectively, to current practices of physicists and engineers for high-accuracy measurements of shorter distances and to such measurement of longer distances by astronomers and geodesists. Physicists generally rely on wavelength counts made with the help of an interferometer. Astronomers, on the other hand, make direct use of the speed of light, using radar techniques to measure the time it takes a light pulse to travel between the end points of the distance being measured. The travel time times the speed of light gives the distance. In this way, using the latest value for the speed of light, NBS scientists recently determined the distance to the moon with an accuracy of a few parts in 10 to the 10th.

The CCDM report expressed the hope that, whichever type of redefinition is finally adopted, it would be so formulated that the associated value of the speed of light would be the same as the one recommended in the report.

Reprinted from "Dimensions," by arrangement with the US National Bureau of Standards.

The European calculator market war

Lacking a solid manufacturing base in Europe, Japanese calculator makers are slowly losing out to the multinational manufacturing and marketing skills of the Americans. The calculator/price performance war in Europe has become so fierce that success in this field will increasingly demand decentralised manufacturing facilities. Here, trade restrictions, cultural and psychological barriers are severely inhibiting Japanese manufacturers.

by GENE GREGORY — PART 2

Multinational organizational structure, strategies and skills are indispensible to success in today's calculator market. Production of the new generation of calculators finds little competitive advantage in centralized supply of world markets from a single manufacturing facility. The emerging pattern of the industry is one of decentralized manufacturing units close to the market, changing the comparative advantage from firms specialized in mass assembly management techniques to those adept at operating multinational production organizations. Once again, here the advantage shifts in favour of the American component makers who already have manufacturing capabilities strategically located throughout the world.

Texas Instruments, one of the most aggressive US component manufacturers to move into the calculator field, has twelve such manufacturing facilities in Europe alone, and has its own marketing subsidiaries in every major European market. Likewise, Litton Industries has two office equipment production subsidiaries in Europe—Imperial in the UK, and Triumph/Alder in Germany—in addition to its strong US—based Monroe Calculator operation. And North American Rockwell has recently acquired Shamlock Compucorp of the UK, the pioneer of the European electronic calculator industry, as its production base for penetration of European, African and Middle East markets.

Above, the Canola F-10 Scientific calculator as marketed by Canon Incorporated. It is with high technology machines such as this that Canon hopes to maintain a viable European market. (Photograph courtesy Rank Industries Australia).

While Japanese manufacturers have yet to make the move to establish production in Europe, direct investment in manufacturing has become an aboslute imperative if they are not to lose a market in which they sold 1,284,000 calculators in 1973. Ricoh, Eiko business machines and other makers have already set up production facilities in the United States in an effort compete with the explosive American industry on its home grounds, and it is now only a matter of time before Japanese makers begin setting up calculator production in Europe. However, time is money, as the saying goes, and may well prove to be the most essential factor of success in the present highly volatile and rapidly changing calculator market.

Investment in production would overcome several handicaps that dull the fine cutting edge of Japanese competitive power in Europe. Distance from the market could hardly be greater, which means higher transportation costs for Japanese calculators landed in Europe—especially if the manufacturer is dependent upon American supply of semiconductors. It is also true, especially for the low-cost one-chip standard calculators, that there is no advantage over European-based production in manufacturing them in Japan or countries of Asia where labour costs are lower. And, despite this change in the economies of the industry, imports of Japanese-made calculators in Europe are subject to a variety of trade restrictions.

The American firms are not subject to the same trade restrictions. In addition, US production is considerably closer to the market and the major American producers already have production operations or capability in Europe. Moreover, with the likelihood that more European firms will succumb before the end of 1975 and others in 1976, US firms tend to be in a better position financially and managerially to take over European companies or their calculator operations.

Takeovers, which few Japanese firms have ventured to undertake in Europe as yet, may be the only answer to the time problem. The opportunity is certainly there. Facit, which has close ties with Sharp, was recently put on the bloc for takeover when it became necessary to dismiss 2,400 employees from the firm's mechanical adding machine factory, as a result of competition from Japanese electronic calculators. Although the Swedish

office equipment maker has gained a new lease on life from being absorbed into the Wallenberg Electrolux group, there are still doubts that Facit can survive on its own apart from one of the large multinational electronics groups. Even Olivetti—despite its backward integration into semiconductors—has been having serious trouble in its UK company, where it recently had large layoffs, and has lost its former position of leadership in European and world markets. The smaller specialized calculator makers are in an even much more precarious position than either of the two largest European companies remaining in the field, and are likely candidates for acquisition by either American or Japanese firms seeking to strengthen their position in Europe.

Most Japanese makers are aware, however, that while the takeover route may offer the shortest and quickest entree to production in Europe, it is a most difficult and risky one as well. Psychological and

The Canon Palmtronic F-5—representative of the Japanese calculators losing out in the price/performance war in Europe.

cultural barriers exist which, while regrettable, are nonetheless real and inhibiting for potential Japanese bidders for a European company. It is exceedingly more difficult to integrate an established European company into a Japanese group than into an American-based multinational.

One thing, then, is certain in this otherwise confused picture.Considerably fewer Japanese calculator manufacturers can produce in Europe than are selling in the European market today. At very best a half-dozen might have the financial and managerial resources to make and sustain the kind of investment that will be required, providing they can put together the necessary mix of factors making for continued competitive advantage in European markets.

Sanyo France has shown the kind of ingenuity necessary for developing new structures to fit the conditions that will

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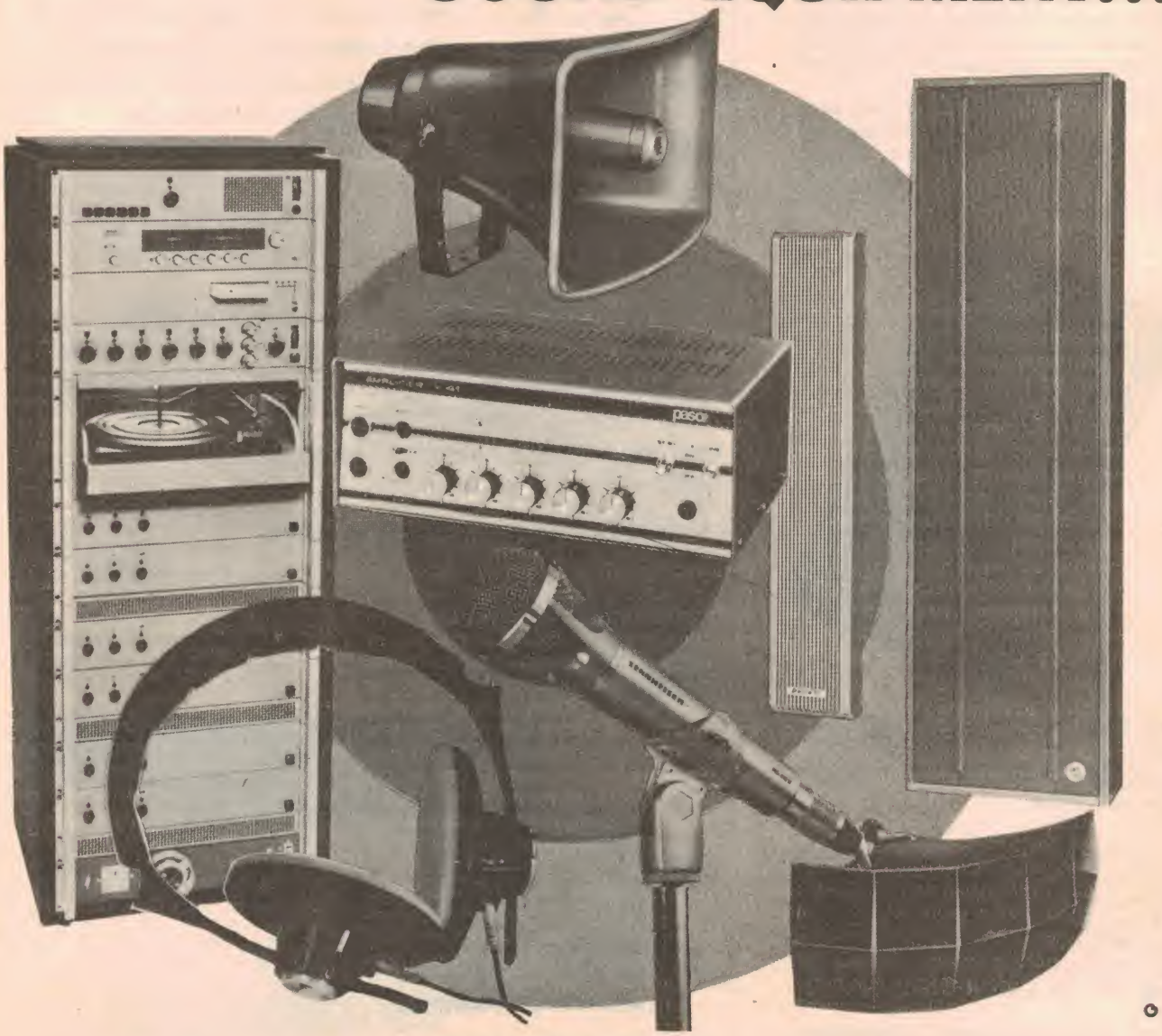

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Japanese exports to Europe ($m)

	1970	1971	1972	1973
Netherlands	16.9	21.8	20.0	23.7
Belgium	1.9	1.9	3.1	2.3
France	3.6	5.5	7.0	7.0
W. Germany	24.3	25.8	33.2	29.8
Italy	1.6	1.3	1.8	3.8
UK	7.7	9.8	10.0	10.9
Norway	1.0	1.0	0.6	1.0
Sweden	4.0	3.1	3.4	3.6
Denmark	1.3	1.2	1.8	1.8
Switzerland	3.7	5.0	6.4	13.9
(Sub-total)	66.0	76.4	87.3	97.8
USA	86.1	86.4	101.0	179.3
Total	152.1	162.8	188.3	277.1

The Lloyd's Accumatic 999 pocket calculator. Offering a range of powerful functions, it is a good example of the American technology now making inroads into the Japanese calculator market in Europe.

determine which of the Japanese manufacturers will be successful in preserving its present share of the European market and moving on to the next stage of global rationalization of operations. Under a new co-production arrangement with the Société COFELEC-Memoires, a subsidiary of the Thomson-CSF group specializing in production of electronic memories, Sanyo will manufacture a highly versatile programmable billing and accounting machine capable of receiving 512 or 1,024 instructions, depending upon the model.

Now undergoing market tests in Japan, this Sanco (Sanyo-COFELEC) desk top system is built on the concept that instruction steps to the machine should be possible to be set up by anyone with a modicum of intelligence, without recourse to special computer languages, and without need for memorizing jargon and code words. The idea is to have a relatively inexpensive multi-purpose machine, with print-out memories and ability to accept and perform a host of calculating, billing and accounting functions, quickly and economically.

As an alternative to more expensive and complicated computer-based solutions to office automation, the new Sanco machine is designed for the vast market of small and medium-sized enterprises. Its lower initial cost and its ready accessibility without a major staff effort or a radical reorganization of company structures and routines enables Sanyo to tap a large and still relatively unexploited market.

But particularly significant in this approach to the European market is the synergistic feature of Sanyo's industrial strategy. By combining Sanyo's technological and production prowess in calculator production and printers with COFELEC's advanced memory technology and production facilities in France, Sanyo has succeeded, with minimal capital expenditure and loss of time, in adding the kind of high value equipment to its product line that is necessary to strengthen its defences against the rapidly growing intrusion of the large American semiconductor manufacturers.

Assuming that the Americans will take an increasing share of the low medium cost "consumer" calculator market, forcing prices down to the point where margins are so small that profitability will be severely circumscribed, Sanyo—like other Japanese makers—will be increasingly dependent upon its ability to add value to the basic calculator to realize a reasonable return on investment.

Another important feature of this co-operation scheme is that it provides Sanyo with the flexibility of sourcing the equipment either from France of from Japan to supply various markets throughout the world, adding the kind of supply flexibility that goes a long way to counter the competitive advantage of American multinationals.

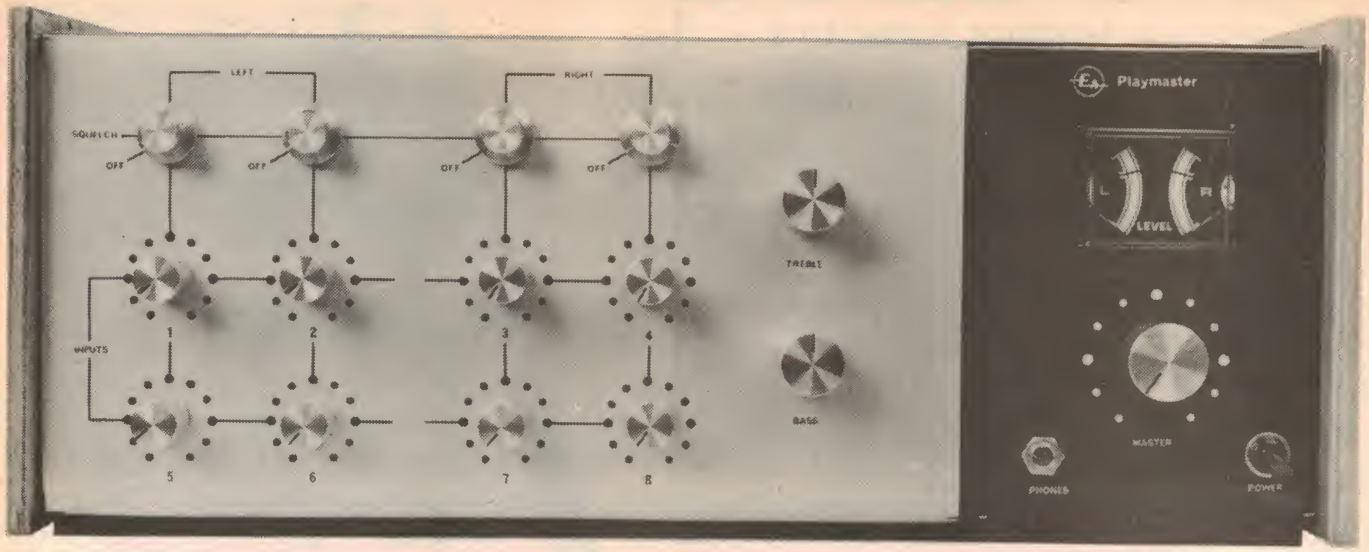
As Japanese firms develop their response to the rising tide of American calculators, others will undoubtedly follow Sanyo's example. Still others can be expected to invest directly in production facilities to manufacture in Europe those models with the largest market demand and the longest potential life-cycle. How fast the various Japanese makers move will determine the extent of their loss of market share to the competition, and which of the Japanese makers will be ultimately counted among the survivors.

Just what the future holds for calculator production in Hong Kong, Taiwan, Korea and Singapore is still somewhat problematical. For the immediate future, large European retail and mail order houses are likely to continue imports from the Far East. Ultimately, however, these manufacturers may find themselves at the mercy of semiconductor suppliers who are likely to be the main competitors of Asian output.

The distance from the final consumer and the absence of captive marketing channels will likely mitigate against Asian producers not integrated into either American or Japanese manufacturing groups. And the lower labour intensive production American and Japanese methods will doubtless deprive non-Japanese Asian manufacturers of much of their competitive advantage.

Indeed, it is Asian manufacturing competing on price alone and selling directly to large retail organisations who will be the first victims of the impending shakeout. Since their only entree to the market is price, Asian calculator makers will lose their market as soon as American producers succeed in penetrating their price range. If the moment of truth has not yet come, the full impact will, in all probability, be felt sometime this year when US-made low-cost pocket calculators are expected to retail for the equivalent of $5.00.

This bad news comes at a time when calculators from Taiwan, Hong Kong and Singapore are just beginning to get a foothold in Europe. Last year imports from the far East, other than Japan, by Germany alone amounted 170,000 machines. And despite the EEC's policy of general preferential treatment of imports from developing countries of Asia, a policy which does not encourage the import of electronic products using a high percentage of foreign-made components, the upward trend of Asian calculator shipments could have been expected to continue. Now, in the face of massive American competition, this likelihood must be heavily discounted.



PLAYMASTER 145

. . . our new eight input stereo/mono mixer

Many of our readers require a multi-input stereo mixer with comprehensive facilities such as automatic muting, tone controls, headphone monitoring, signal metering and the ability to handle a whole range of signal sources. Here is the first article on our answer to your requirements, the Playmaster Mixer.

by LEO SIMPSON

In the steady stream of correspondence which we receive from our readers we often have letters indicating a need for a multi-channel mixer. And the often the readers' needs cannot be satisfied by those mixers we have published in the past seven or eight years.

So recently we decided to look at the many facilities required by our readers and see what could be incorporated into a new mixer, without making it into a complex monster.

Right at the outset, let us state that few people seem to want the most basic of mixer stages which only have unity gain. Often, considerable amounts of gain are required.

For example, a common requirement in a simple mixer, as requested by our readers, is the ability to accept inputs from a couple of low impedance microphones and maybe a few high level sources such as a radio or stereo recorder, mix them and then feed the output signal into the high level inputs of a stereo cassette deck. This sort of request comes from amateur tape recordists whose machines do not have mic/line mixing. As an afterthought, these readers often request that the mixer have tone controls. Now these requirements are all quite reasonable but they do not add up to what could be called a "simple mixer".

Another group of readers who often write to us about mixers are those who are members of pop and jazz bands. These days, the trend is to feed all the inputs from microphones and amplified instruments such as guitars, keyboards and synthesizers, into one master mixer and then into one or more amplifiers having a power output of several hundred watts.

Here, not only must the mixer cater for a wide range of input and impedance levels but it must have more inputs; as many as twelve would not be excessive for some bands. As well, these people require output level monitoring so that they do not overdrive their expensive amplifiers and loudspeaker systems.

A third grouping of readers who require mixers are those who are members of amateur stage societies. These people require a stereo mixer to feed a stereo public address system. They often have as many as eight microphones spread across the stage with perhaps one or two off-stage. Again, they require output level monitoring.

Headphone monitoring of the output signal is often quoted as another desirable facility, by the three groups of potential users.

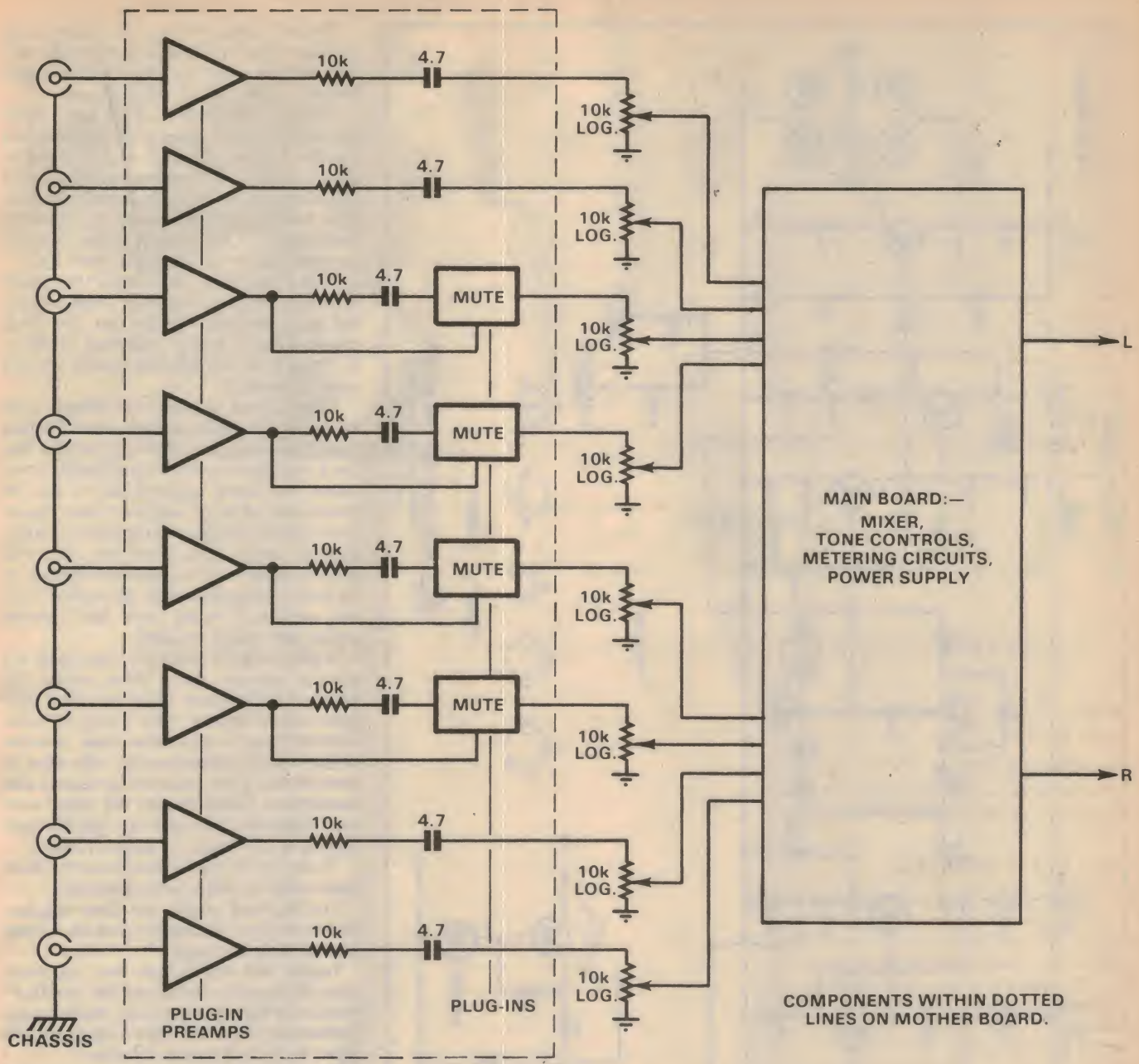
So all these readers really want a fairly elaborate mixer. And that is without mentioning specialised features such as pan pots, tone controls on each input channel and even octave equalisers. If we incorporated all these features we would have produced a monster which only relatively few readers would be game to build.

What we have produced is a new Playmaster mixer which will cater for a total of eight inputs, (four per channel on a stereo basis), has tone controls, output signal monitoring and stereo headphone socket for monitoring. With the two output channels bridged together it can be used as a mono mixer with eight inputs.

One of the problems with complex mixers, both commercial and those we have seen in other magazines, is that they tend to be noisy when all inputs are running with high gain. The situation can be particularly bad where several low impedance microphones are used. Because they have such a low signal output voltage to begin with, typically several hundred microvolts, they inevitably give a poor signal-to-noise ratio when plugged directly into a preamplifier.

Professional equipment used in broadcasting and recording studios gets around this problem by using low impedance microphones with balanced lines and step-up transformers. The balanced lines eliminate hum and other mains-induced noise while the step-up transformers improve the inherent signal-to-noise ratio of the system by increasing the signal level to the preamplifier.

Unfortunately, microphone transformers are expensive, at a minimum of about $15 each, so we really could not incorporate them into the Playmaster mixer. However, there is another way of



PLAYMASTER 145 MIXER SCHEMATIC

(FILE 1/MX/10)

The schematic shows how the different sections of the Playmaster Mixer are linked together. Twelve plug-in boards are used.

improving the signal/noise ratio.

In a typical situation where a mixer is used, microphone channels with a poor signal/noise ratio will be most noticeable during quiet sections of the program and less noticeable during loud sections. During the quiet sections, chances are that some or all of the noisy microphone channels in question are not actually being used.

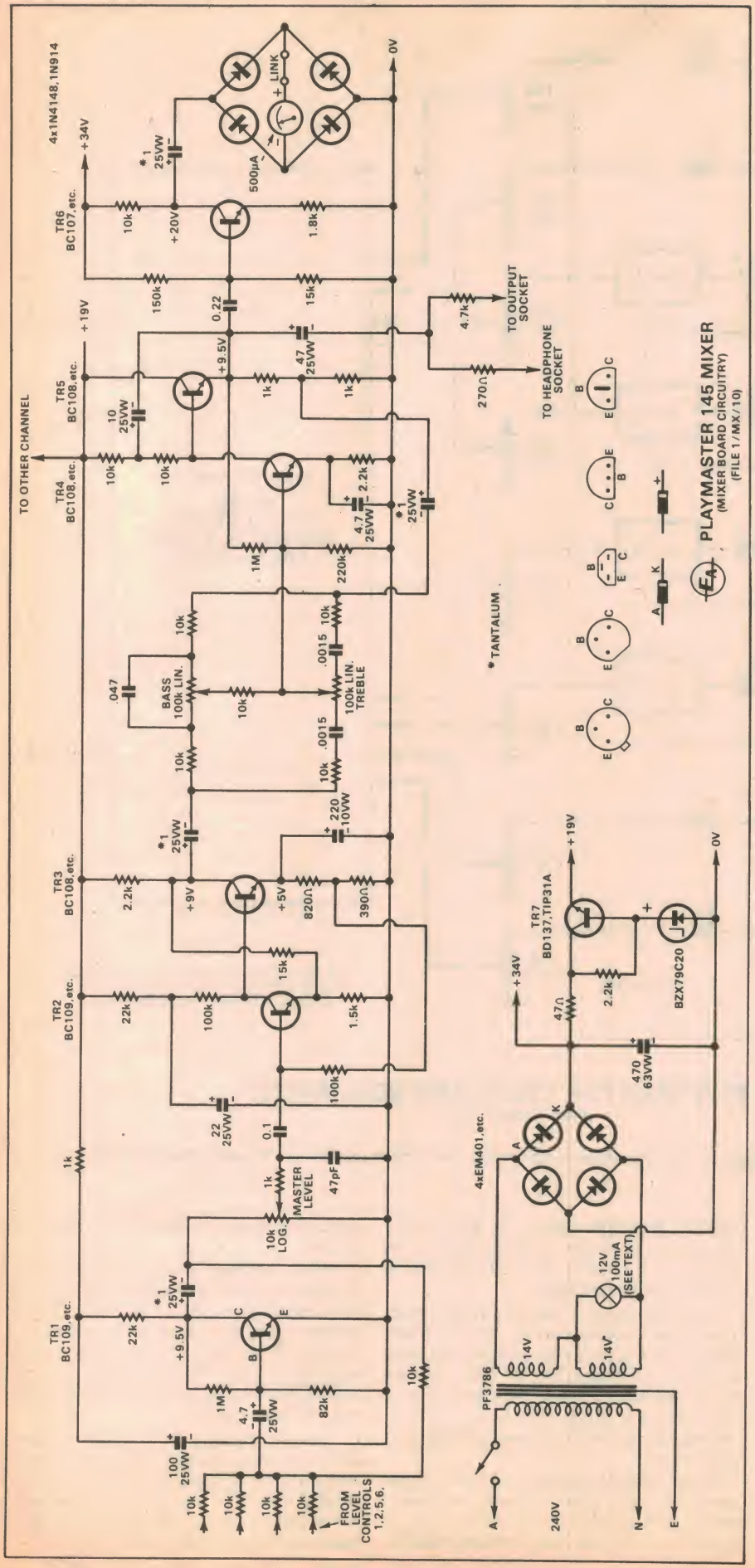
However, in typical use by amateurs, it may not be possible to turn down the unused channels and thereby improve the signal/noise ratio. Of course, in record studios the mixer operator constantly juggles the signal levels and settings to obtain the best program quality. In the amateur situation, the mixer is more likely to be initially set up and then left untouched for the entire program.

Our Playmaster mixer incorporates automatic muting circuits which drastically cut the gain of unused input channels to improve the signal/noise ratio. As soon as the signal level to a given microphone rises above a given threshold, which is adjustable, the input channel is made fully operational.

When initially setting up relative signal levels for each input channel, the automatic muting can be switched out of operation using the same control used to adjust the threshold level. More about this later.

Now let us describe some of the physical features of the Playmaster mixer. The chassis is 400 x 150 x 180 (W x H x D) and is a simple U-shape with timber end-covers and a vinyl-covered top panel. Altogether it has fifteen knobs, a toggle switch, headphone socket and dual meters on the front panel.

To avoid making the front panel appear too large, we have split it into two sections, one finished in black while the other has a natural aluminium finish. The prototype front panel was made from Scotchcal photosensitive aluminium.



On the black section of the panel is the master level control and immediately above it, the dual level meters. This seems to be a fairly logical arrangement.

On the other section of the front panel are the two tone control knobs, level knobs for the 8 input channel, and four knobs which control the muting threshold and also switch it out of operation if required. The muting facility is only provided on four inputs in the prototype but this can be extended to all inputs if need be.

The four input level and two mute threshold controls for each output channel are grouped together on the front panel. Thus, a group including knobs 1, 2, 5 and 6 on the LH side serves the left output channel.

Other panel layouts and chassis configurations could have been used. Sloping panels are common. However, we felt that for a universal mixer the configuration we chose was most appropriate. It can be placed on a shelf or on top of other equipment and all settings are visible from some distance away. This is not the case with sloping panels. It would also appear to be more compatible with the vertical control panels of many tape and cassette decks now being retailed.

Slider controls have not been used, for several reasons: for a start, unless the better quality 60mm types are used, they give a poor control "feel"; they are considerably more expensive than conventional rotary potentiometers; the need to provide brackets and slots in chassis and escutcheon panels makes the metalwork very expensive and dirt can quickly gain ingress to the track, to make it noisy.

To top it off, the author is not particularly keen on slider potentiometers.

On the back panel, we have standardised the input and output sockets. 6.5mm jack sockets are used.

Inside the chassis are two relatively large PC boards, one we call the "mother" board and the other the main mixer board. Reference to the schematic diagram will show how it all comes together.

Twelve edge connectors are mounted on the mother board. The connectors mate up to eight small preamp boards and four mute boards. The preamp boards have the same universal pattern but can be wired up to suit quite a range of input sources. In this way, the mixer can cater for high level inputs such as tape recorders, electronic keyboard instruments and synthesizers, and low level inputs such as low or high impedance microphones, magnetic cartridge, ceramic cartridge, electric guitar and so on.

The mother board not only provides a convenient method of plugging in preamp and mute boards but also eliminates the tedious job of wiring up and mounting all those eight-way edge connectors.

Dimensions of the mother board are 127 x 178mm (code 74mx12d) while those for the mixer board are 100 x 200mm (code 74mx12b).

Each channel on the mixer board has four inputs, each with a maximum sensitivity of 40mV at 10k input impedance

for the nominal output level of 0.775V RMS. The nominal ouput level of the mixer can be varied easily up or down by changing a few resistors on this board. This enables the mixer to drive any amplifier to full power.

Refer now the circuit diagram of the main mixer board. This contains the mixer stages, tone controls, metering circuits and the regulated power supply. The circuit shows one channel on the mixer board, plus the common power supply.

Tr1 is the mixer stage which accepts the signals from the wipers of four level controls. Shunt negative feedback is applied from the collector of the transistor to its base—it could be referred to as a virtual earth mixer. The gain is unity, fixed by the ratio of the feedback resistor (10k) to the input resistor (also 10k).

A 22k resistor provides the DC collector load for the mixer stage but because the considerable feedback applied around it the output impedance is low, so that it can feed the 10k master level control without being unduly loaded.

A mixer stage such as this, with unity gain, can handle four inputs with negligible interaction, distortion and noise.

Following the master volume control is a direct-coupled transistor pair, Tr2 and Tr3, which provide a stage gain of 10. This circuit is interesting because it has two feedback loops, one predominantly AC and the other DC.

DC feedback is applied from a voltage divider in the emitter circuit of Tr3 and via a resistor to the base of Tr2. This provides the base bias for Tr2 and effectively sets the DC conditions for the whole stage; this sets the voltage at the collector of Tr3 at a nominal 9 volts DC.

AC feedback is applied from the collector of Tr3 to the emitter of Tr2. The gain of 10 is set by the ratio of the 15k resistor to the 1.5k resistor. Note that the 15k resistor provides a DC path so that to some extent, the 15k resistor provides a second DC feedback path which tends to interact with the DC feedback path mentioned above. This means that an alteration to AC feedback requires an adjustment to the biasing conditions.

Output from the collector of Tr3 is fed via a 1uF capacitor to the tone control section comprising Tr4 and Tr5. This circuit is quite different from those we have used in the past which have employed a single transistor—the common Baxandall negative feedback tone control.

Our tone control circuit is based on a design by P. M. Quilter featured in Wireless World in April 1971. Basically, it consists of common-emitter amplifier stage with an emitter-follower. The emitter follower provides an output buffer for the relatively high collector load of Tr4 and also supplies a bootstrap voltage to effectively raise the value of this collector load.

Bootstrap voltage, ie, positive feedback with almost unity gain from the collector of Tr3 (via the emitter-follower) is coupled from the emitter of Tr5 by a 10uF capacitor to the junction of two 10k resistors which form the collector load of Tr4. Since the AC voltage at the junction of the two 10k resistors is almost the same as at the collector of Tr4, very little AC current flows in the "lower" 10k resistor and so Tr4 "sees" a very high value of collector load, much higher than 20k.

This means that the open loop gain of the stage becomes very high and with the application of negative feedback, the distortion is very low. Thus the performance of this circuit is significantly improved over the common single transistor tone control stage. Distortion of this section is typically less than 0.01pc. over the whole audio range.

Another difference between our circuit and those published in previous years is that it has a "constant turnover, variable slope characteristic" whereas those published previously have a "variable turnover, constant slope". Slope refers to the rate of boost or cut in the circuit; this is a maximum of 6dB/octave for any typical tone control circuit.

Turnover refers to the frequency above which, in the case of the treble control, boost or cut occurs. In the case of a variable turnover, constant slope tone control, the frequency above which treble boost or cut occurs varies with the setting of the tone control, while the slope above this frequency remains constant at 6dB/octave.

By contrast, in a variable slope, constant turnover tone control as featured here, the slope is altered by the tone control while the turnover frequency remains the same. For the same time constants, both tone controls systems will give the same amount of maximum boost or cut but the variable slope control will seem to be more progressive in its operation.

A look at the tone control performance curves shows why. The solid lines show the amount of boost or cut available at maximum and half settings of the controls. The dotted line shows the amount of bass boost available at half boost setting for an equivalent "variable turnover" control.

As can be seen, what boost does occur is below 100Hz and will not be apparent on much of music programs. In contrast the variable slope control gives quite a reasonable amount of boost to frequencies above 100Hz at the half boost setting, and thus will sound quite effective.

This means that while the variable slope tone control sounds quite progressive in its action, the effect of the variable turnover control "seems" to be compressed into the ends of the control rotation—nothing appears to happen over much of the control rotation. For this reason, "apparent effectiveness", we have used the variable slope control in the Playmaster mixer.

One small drawback with the circuit as we have used is a certain amount of interaction between the bass and treble controls; if the treble control is fully boosted and then the bass control is fully boost or cut, the amount of treble boost is reduced by about 2dB at the extreme highs. However, use of the treble control does

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TYPE No. PL30/40VA					
Series Connections:	15 + 15	15 + 12	12 + 12	15 + 3	3+ 3
Volts at 1.33 Amps:	30V	27V	24V	18V	6V
Parallel Connections:					
Volts at 2.67 Amps:	15V		12V		3V
TYPE No. PL50/40VA					
Series Connections:	25 + 25	25 + 20	20 + 20	25 + 5	5 + 5
Volts at 0.8 Amps:	50V	45V	40V	30V	10V
Parallel Connections:					
Volts at 1.6 Amps:	25V		20V		5V
TYPE No. PL30-9/40VA					
Series Connection:	15 + 15				
Volts at 0.5 Amp:	30V with 9V at 3 Amps				
Parallel Connection:					
Volts at 1.0 Amp:	15V with 9V at 3 Amps				

LOW HEIGHT POWER TRANSFORMERS 20VA

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PL15/20VA	15 volts at 1.33 amps	7.5 volts at 2.67 amps
PL18/20VA	18 volts at 1.11 amps	9 volts at 2.22 amps
PL24/20VA	24 volts at 0.83 amps	12 volts at 1.67 amps
PL30/20VA	30 volts at 0.67 amps	15 volts at 1.33 amps
PL40/20VA	40 volts at 0.50 amps	20 volts at 1.00 amps
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PF162	6.3V-3A, 6.3V-3A CT or 12.6V-3V CT if series connected.
PF2565	12.6V-0.5A, 12.6V-0.5A or 25V-0.5A if series connected or 12.6V 1A parallel windings.
PF2851	12.6V CT at 0.15 amp
PF3785	14V 80ma, 14V 80ma
PF3559	15V-0-15V-1 amp
PF537	17V tapped 11.5V-0.4A
PF265	17V tapped at 11.5V, 10V, 8.5V, 4.2A
PF3783	18V at 60ma, 18V at 60ma
PF2440	19.4V, 0, 19.4V-1.5A DC
PF3259	25V, 2 amp, 25V 2amp shield
PF3577	28V, 0, 28V-2A
PF1763	30V tapped at 25V, 20V-2A
PF2876	32V-1 amp 32V-1 amp E. S. Shield
PF2235	150V, 125V, 100V, 75V, 50V, 25V, or 75V, 0V, 75V, at 30ma 6.3-1.2A

TYPE NO.	MAX VA.	SECONDARY RATING
PF3789	75	3, 6, 12, 15, 18, 24, 27, 30V At 2.5 amps OR 3.12.15V at 5 amps Fitted with E. S. Shield
PF3785	105	7, 14, 28, 35, 42, 56, 63, 70v OR 6.5, 13, 26, 32.5, 40, 52, 57.5, 65v At 1.5 amps OR 7, 28, 35v At 3 amps OR 6.5, 26, 32.5v at 3 amps Fitted with E. S. Shield
PF3788	120	3, 6, 12, 15, 18, 24, 27, 30v At 4.0 amps OR 3, 12, 15v at 8 amps Wound on divided bobbin
PF3784	210	7, 14, 28, 35, 42, 56, 63, 70v OR 6.5, 13, 26, 32.5, 40, 52, 57.5, 65v At 3 amps OR 7, 28, 35v at 6 amps OR 6.5, 26, 32.5v At 6 amps Fitted with E. S. Shield
PF3783	350	7, 14, 28, 35, 42, 56, 63, 70v OR 6.5, 13, 26, 32.5, 40, 52, 57.5, 65v At 5 amps OR 7, 28, 35 At 10 amps OR 6.5, 26, 32.5v at 10 amps Fitted with E. S. Shield

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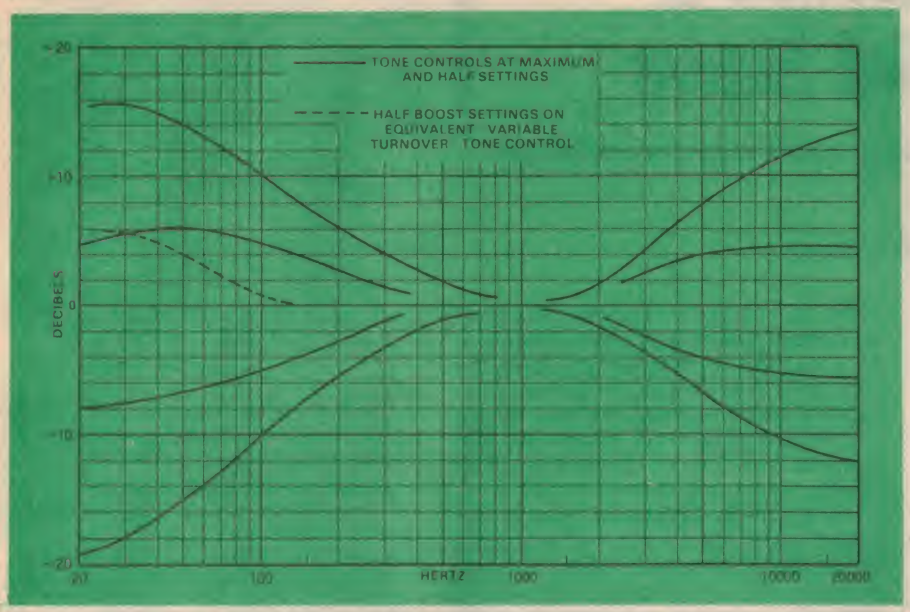


These curves show the performance of the tone controls at half and maximum settings.

not similarly reduce the amount of bass boost or cut available.

We feel that the drawback is a small disadvantage and it is seldom that full bass boost and full treble boost are applied simultaneously.

As the tone control curves show, generous bass and treble boost and cut is available at the extremes of control rotation, while there is very little interaction with the mid-frequencies. 10k limiting resistors are placed in series with both sides of the tone control potentiometers. This prevents the boost and cut from being excessive at very low frequencies, and at very high frequencies. This improves stability and helps prevent acoustic feedback.

Since the tone control stage has a very low output impedance due to the large amount of negative feedback (stage gain is two) it can drive a pair of stereo headphones via a resistor of only a few hundred ohms, 270 ohms in this case. This resistor is selected so that when the mixer is delivering slightly more than the maximum nominal output signal, ie, 0.775V RMS in the case of this circuit, the signal becomes distorted due to current limiting in the tone control stage.

This warns the person monitoring the mixer output signal with headphones that the power amplifier is being overdriven. If the nominal output of the mixer is changed to suit another amplifier, the 270 ohm resistor is changed accordingly to give an audible warning when the power amplifier is being overdriven.

With the headphones disconnected, the mixer output does not clip until the signal rises to about 5V RMS.

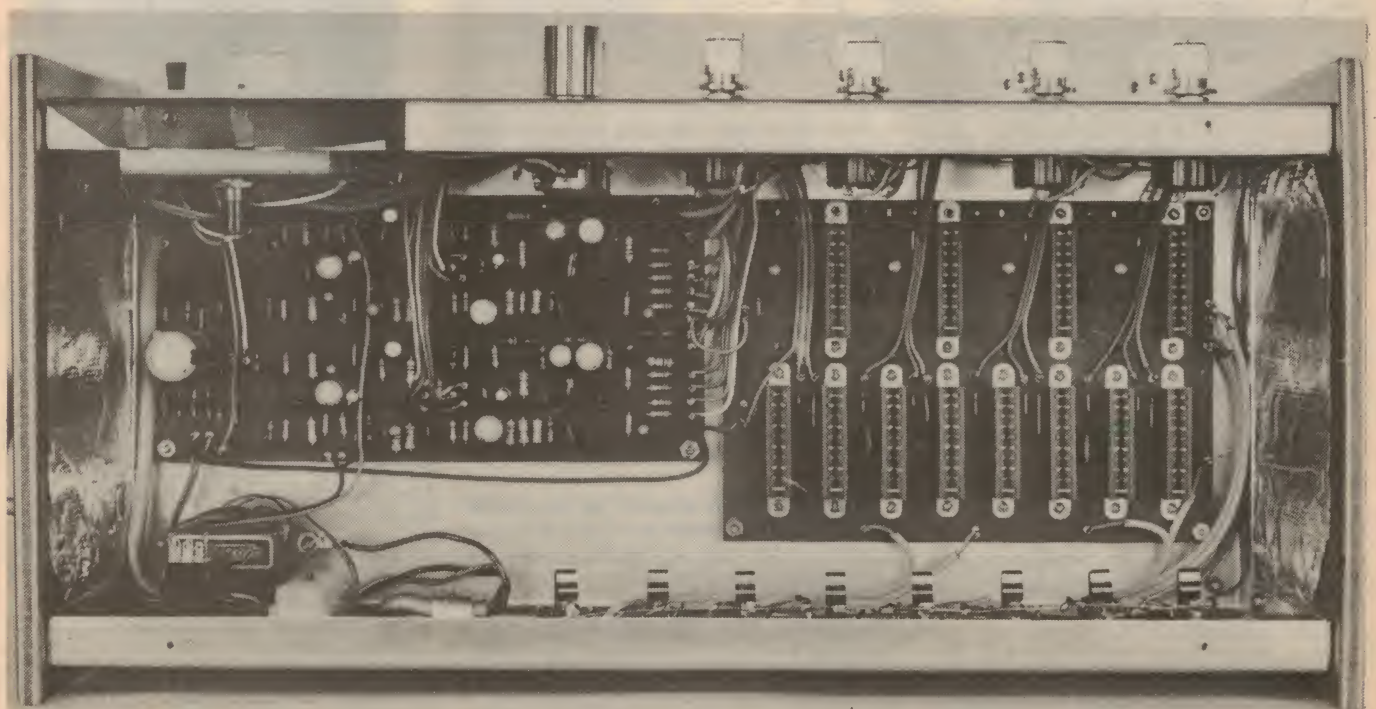
Output from the tone control stage is coupled to the output socket of the mixer via a 4.7k resistor so that it can drive amplifiers with a low input impedance. The 4.7k resistor can be reduced to 1k, if necessary.

The output signal of the mixer is amplified by Tr6 and then fed to a bridge rectifier and meter to provide signal monitoring.

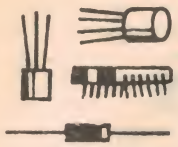
The power supply is derived from the mains via a small bobbin-wound transformer, Ferguson PF 3786 which has two 14V windings connected in series to give 28V. This is fed to a bridge rectifier to give a nominal 34V DC which is fed to the metering stages, ie, Tr6.

All the other circuitry in the mixer is powered from a 19V supply. This is derived from the 34V rail via a zener diode network and emitter-follower regulator, Tr7. The 47 ohm resistor renders Tr7 short-circuit proof. This is a very worthwhile feature, as the author can testify from repeated experience.

The second article on the mixer will describe the various plug-in preamps and the mute circuitry and give details of construction. *(To be continued.)*



An interior view of the mixer showing main mixer PC board and the "mother" PC board with its twelve edge connectors.



What's new in Solid State

7-IC set for PAL colour receivers

The Italian semiconductor firm SGS-ATES has announced its plans to market a family of 7 ICs, designed to cover virtually all of the signal processing circuits of a PAL colour TV receiver. Three of the seven are now fully developed and are shortly to be in full production, while the other four are still in development.

Four of the devices will be equally suitable for monochrome receiver use.

SGS-ATES explains that the devices are being planned and designed as a complete and rationalised family, to avoid the sort of problems which have been created by the use of ICs in TV receivers to date. With many different manufacturers producing ICs, but many making only a few devices based on different integration philosophies, serious interfacing complications have arisen.

Warburton Franki, who represent SGS-ATES in Australia, are currently encouraging local monochrome and colour TV makers with a view to designing their "next generation" receivers around the new IC family. With interfacing problems solved, there are significant advantages in terms of reduced initial cost, inventory and long-term servicing costs.

The devices in the family are as follows: TDA440 provides the gain controlled video IF, synchronous detector, AGC keyer stage, AGC amplifier, and video preamp. TDA1180 provides sync separator, noise gate, horizontal oscillator and AFC. TDA1140 provides ACC detector, APC oscillator, colour killer, PAL ident and switch.

TDA1150 provides luminance and chrominance amplifiers, DC contrast and saturation control, brightness control, beam current limiting and black level clamping, control for ACC and colour killer, burst gate and blanking, and delay line driver.

TDA1160 provides the R-Y and B-Y synchronous demodulators, the G-Y matrix, RGB matrix and RGB preamplifiers.

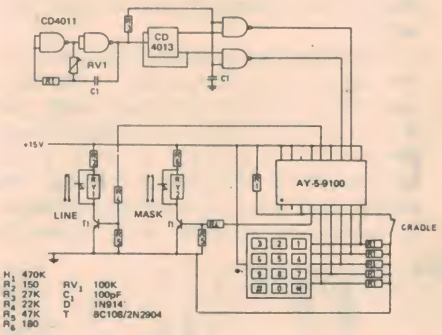
TDA1170 provides the complete vertical deflection system.

TDA1190 provides the complete sound channel, from SIF amplifier through to the power output amplifier, with DC volume control.

Warburton Franki anticipate that the cost of the complete set of ICs is likely to be in the vicinity of $30, exclusive of tax.

Passing from consumer electronics to more specialised devices, General Instrument Corporation has released a new LSI device designed to form the heart of a push-button telephone. Designated the AY-5-9100, the new device runs from a single 15V supply rail and requires two phase clock signals at 18kHz.

The device is designed to accept the output signals from a standard tone dialing keyboard directly, without external encoding. It provides outputs for driving NPN relay switching transistors for both line and mask contact operation. The diagram shows how the device is typically used in a mains-powered situation, with a CMOS clock generator circuit.



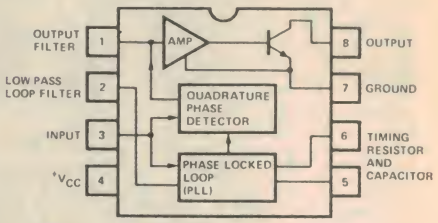
The AY-5-9100 can also be used with other keyboards, such as a "2 of 7" touch tone type or a 1 of 10 single contact type. It can equally easily be adapted for use as a punched-card dialler, or with a companion AY-5-9200 device in a multi-number repertory dialler.

In view of PMG restrictions, the device will no doubt be of academic interest only as far as the public telephone network is concerned. However those wishing to make up "state of the art" private intercom telephones or data terminals could find it of considerable interest.

Further details should be available from the local agents for GIM, General Electronic Services of 99 Alexander St, Crows Nest NSW 2065.

Another interesting new device is a "monolithic tone decoder" from Exar Integrated Systems, of California. Designated the XR-567, the device is intended for general-purpose tone and frequency decoding. It can also be used as a low speed FSK demodulator, at data rates up to about 100 baud (bits per second).

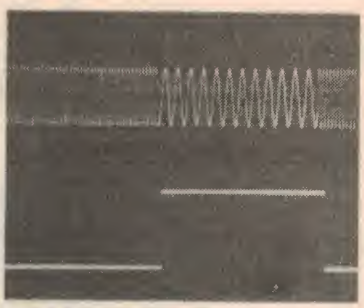
As shown in the functional block diagram, the device is based on a phase-locked loop (PLL). The VCO frequency of the loop may be set to any frequency within the range .01Hz–500kHz, by means of external R and C, and the LP filter characteristic may also be set externally to adjust capture bandwidth.



The PLL oscillator output and the input signal are fed to a quadrature phase detector, whose output is filtered and fed to an amplifier stage driving a power switching stage. This becomes the logic output of the device, and is capable of sinking up to 100mA of load current.

When an input tone within the passband of the circuit is present, the PLL locks on the signal and the quad detector DC output level shifts. This shift is amplified and used to switch the output transistor, which has a Vce of typically 0.6V at 100mA.

By adjusting the bandwidth of the PLL, the circuit can be made to operate over a variety of input signal amplitude levels with high noise rejection. Typical performance at 100mV RMS input gives clean output decoding even with noise of 6dB greater amplitude than the signal.



FSK decoding using the XR-567

An interesting possible application of the SR-567 is in low-cost data recording systems using cassette tape recorders.

Local agents for Exar are A. J. Ferguson, of 29 Devlin Street, Ryde, NSW.

The final item this month is a handy data sheet on solid state infra-red emitters and injection laser diodes from RCA. This gives a listing of all the devices in the RCA range, together with brief specs. It is available free and post free from the Amalgamated Wireless Valve Co, PO Box 24, Ashfield NSW 2131. (J.R.)

For further data on devices mentioned above, write on company letterhead to the firms or agents quoted. But devices should be obtained or ordered through your usual parts stockist.

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Simple function generator uses two low-cost ICs

Using only two integrated circuits, this versatile unit can generate square, triangle and sinusoidal waveforms over the full audio frequency range.

by DAVID EDWARDS

This oscillator is based on a new linear IC, the Intersil 8038 Waveform Generator. Utilizing advanced monolithic technology, such as thin film resistors and Schottky-barrier diodes, it produces sine, square and triangular waveforms with high accuracy. To this we have added a simple op amp buffer, and produced an economy function generator with a host of desirable features.

Our generator produces three different waveforms from 2Hz to 20kHz, in four ranges. The distortion of the sine wave output is less than 1 percent, while the triangle wave has better than 0.1 percent linearity. The output levels of all waveforms are constant to within 0.2dB, independent of frequency. Two outputs are provided, both with 600 ohm impedance level, and both short circuit proof.

These outputs are fully floating, allowing hum problems due to earth loops to be minimized, and facilitating interconnection into earthed systems.

Provision has also been included for a control input, allowing FM and sweep waveforms to be generated. Housed in an attractive gray plastic and aluminium case, this unit should be a worthwhile addition to any experimenter's array of test equipment.

The mode of operation of the waveform generator IC is best explained in conjunction with Fig. 1. An external capacitor C is charged and discharged by two current sources. Current source 2 is switched on and off by a flip-flop, while current source 1 is on continuously.

The levels of the current sources are controlled individually by external resistors (not shown), and collectively by varying the voltage at a control pin (pin 8).

Assuming that the flip-flop is in a state such that current source 2 is off, then the capacitor is charged with a constant current I. Thus the voltage across the capacitor rises linearly with time. When this voltage reaches the level of comparator 1 (set at ⅔ of the supply voltage), the flip-flop is triggered, changes state, and releases current source 2.

This current source normally carries a current 2I, thus the capacitor is now discharged with a net current I, and the voltage across it drops linearly with time. When it has reached the level of comparator 2 (set at ⅓ of the supply voltage), the flip-flop is triggered into its original state, and the cycle starts anew.

The triangular waveform, which is developed across the capacitor, is fed internally to a buffer amplifier and is available for external use at the output pin 3. Similarly, the square wave output is taken from the flip-flop and fed to another buffer amplifier, and is made available for external use at pin 9.

The sine wave output is generated from the triangular wave by means of a non-linear shaping network (sine-converter). This network provides a decreasing shunt impedance as the potential of the triangle moves towards the two extremes.

The sine-converter has four stages of impedance change for each half of the waveform, referenced to a potential

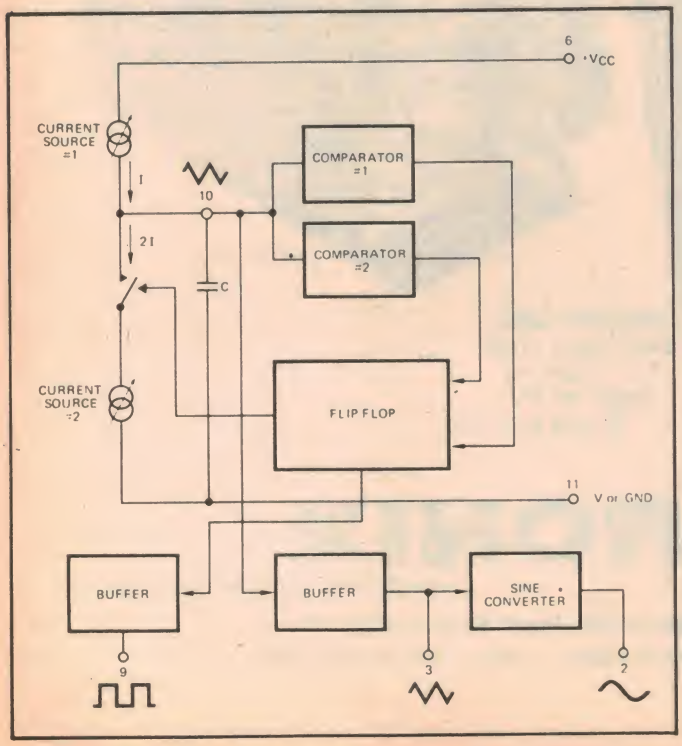
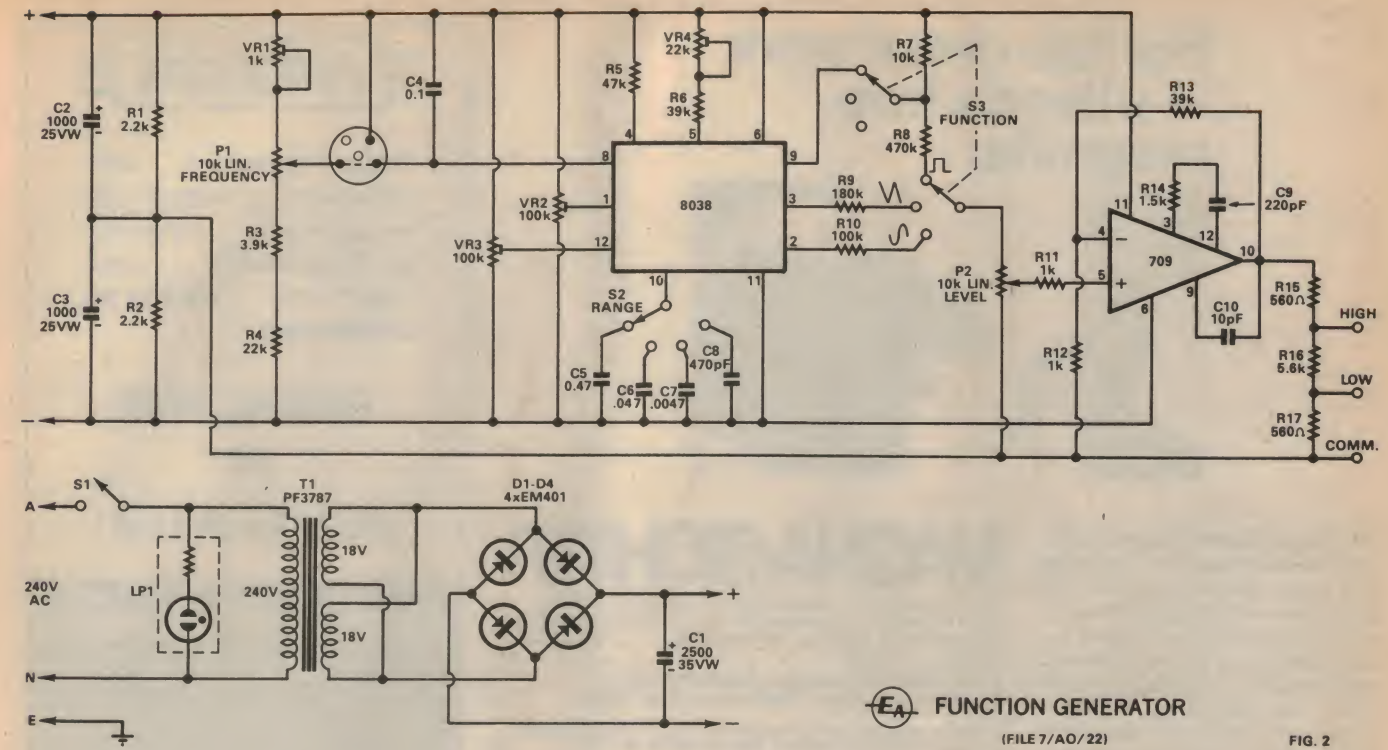


Fig. 1, at left, is the block diagram of the Intersil 8038 waveform generator. Utilising advanced monolithic technology, such as thin film resistors and Schottky-barrier diodes, the circuit is capable of producing sine, square and triangular waveforms of high accuracy. Photograph above shows the completed prototype housed in a plastic case.



divider across the supply voltage. The typical total harmonic distortion of the generator is less than 1 percent, and with careful adjustment, distortion levels as low as 0.5 per cent are possible.

No buffer amplifier is provided for the sine wave output, so that it is necessary to limit the loading on the IC to achieve low distortion figures. This is taken care of in our circuit.

Assuming for the moment that the control voltage on pin 8 is held constant, the charge and discharge currents can be set externally by means of two resistors. These currents are normally made identical, so that the mark-space ratio of the output waveform is unity. This gives minimum distortion of the sine wave output.

By making the charge and discharge currents unequal, asymmetrical sawtooth waveforms can be produced, along with a square waves with a duty cycle ranging from about 1 to 99 percent. Of course, if this is done, the sine wave output is no longer useful, as the distortion increases enormously.

Perhaps the most important result of the mode of operation used is that the frequency is not dependent on the supply voltage, even though none of the voltages are regulated inside the integrated circuit. This is because both the comparator thresholds and the charging and discharging currents are direct linear functions of the supply voltage, and thus their effects cancel.

This means that it is unnecessary to use a regulated power supply, which leads to a reduction in the cost of the completed project.

The second advantage gained from this mode of operation is obtained when the voltage on pin 8 is varied. In this case the frequency can be directly related to the control voltage. Even though both current sources are being varied, the ratio of the two currents, as set by the external resistors, will remain constant. It is thus possible to sweep the output frequency through a large range, without changing the output waveforms in any way.

The third advantage of this mode of operation is concerned with the output regulation. Since the output level of the triangular wave is determined by the comparator switching levels, there is no change in level with a change of frequency. This of course, is also true for the sine wave output.

Turning now to Fig. 2, we can examine the complete circuit. The main power switch, S1, controls the primary side of transformer T1. LP1 is small neon pilot light, provided with a limiting resistor. The transformer we have used is one of the new miniature range recently released by Ferguson. It has two 18V secondaries, which we have used in parallel.

Four small silicon diodes form a bridge rectifier, the output of which is filtered by C1. The nominal output voltage is 26V. This falls to 25V under load.

R1 and R2, in conjuntion with C2 and C3, form a potential divider to split the supply for use with the 709 op-amp. The values chosen represent a compromise between performance and current consumption.

Turning now to the function generator chip itself, we should be able to recognise some of the components mentioned earlier. R5 and R6 are the two current setting resistors. R6 has been provided with a small trimpot, VR4, to function as a fine adjustment. This allows the mark-space ratio to be adjusted precisely, giving minimum distortion of the sine wave output.

C5 and C8, in conjunction with S2, form the frequency range selector. With the values we have shown, frequencies from 2Hz to 20kHz can be obtained, in four ranges.

The fine frequency variation is accomplished by P1, in association with VR1, R3 and R4. The ratio of P1 to (R3 + R4) is chosen so that the voltage on pin 8 does not drop below ⅔ of the supply voltage. This parameter is set by the limitations of the 8038 device itself.

VR1 sets the maximum voltage that can be applied to pin 8. This must be adjusted so that P1 varies the frequency over a 10 to 1 range. The need for adjustment is due to parameter variations in the 8038 itself.

We will have more to say about the socket on the rear of the case at a later stage. It is normally shorted out as shown. C4 serves to suppress switching transients.

VR2 and VR3 are fine adjustments to minimize the distortion of the sine wave output. These can be deleted if not required. Similarly, VR4 can also be omitted in cases where there are no facilities for checking, and hence minimizing distortion. In this case, high accuracy resistors should be used for R5 and R6, with R6 increased to equal R5 (47k).

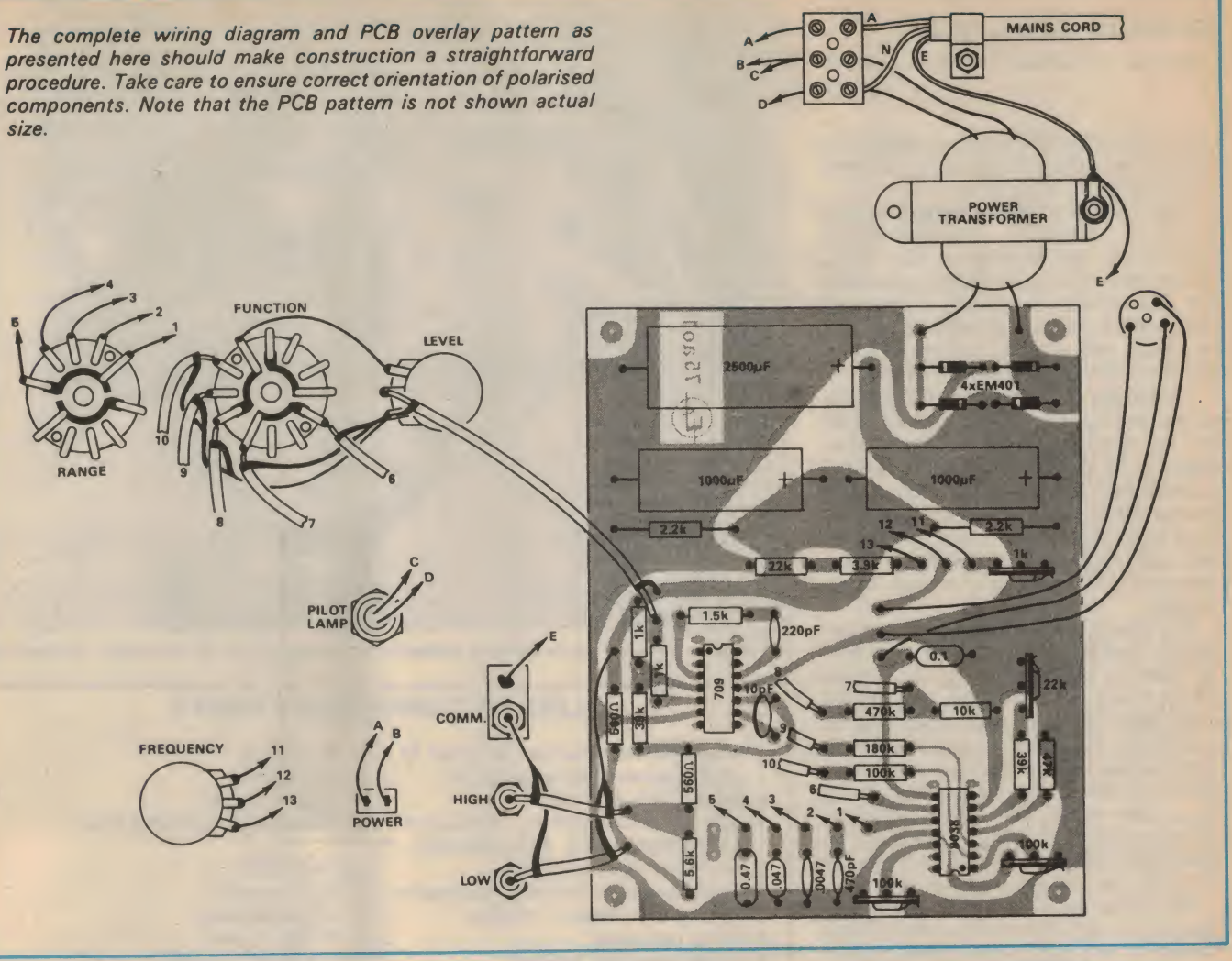
Pins 2, 3 and 9 are the sine, triangular and square wave outputs respectively. As mentioned earlier, the only unbuffered output is the sine output. Pin 9, the square wave output, is an uncommitted collector, and requires R7 as a pull up resistor.

In order to prevent glitches on the other outputs, R9 must be disconnected when the square wave output is not being used. This is the function of the second pole on the function switch.

BIRTHS

SONALERT (Plessey). — February, 1975. To the Professional Components Division, a baby electronic signal with a big voice. Weight ½ oz. (also less than 21 mm thick). Eagerly welcomed by big brothers Mini Sonalert, SC 628 Sonalert and SC 628P Sonalert. This low silhouette newcomer is seeking a good home in automotive, appliance and entertainment equipment. Very lovable, will snap-in fit into 27 mm panel hole with greatest of ease.

The complete wiring diagram and PCB overlay pattern as presented here should make construction a straightforward procedure. Take care to ensure correct orientation of polarised components. Note that the PCB pattern is not shown actual size.



The output level of the generator is set by P2 in conjunction with R8, R9 and R10. These three resistors adjust the signal levels so that all outputs have the same relative peak to peak values. This maximizes the available output signal from the op-amp. Of course, these resistors could be selected so that the RMS levels were the same, but this would be at the expense of limiting the maximum level obtainable for the square and triangular outputs.

The 709 type op-amp forms the output buffer. We selected this type in preference to the 741 type on the grounds of economy, and more importantly, because we could adjust the frequency compensation so that the large signal frequency response extended to well above 20kHz, the highest oscillator frequency.

As the 709 does not incorporate overload protection, we have limited the load to a minimum of 560 ohms. This gives the generator a nominal output impedance of 600 ohms. R16 and R17 form a potential divider across the output, attenuating the signal by 1/10th. The output impedance of this output is also nominally 600 ohms.

An important point to note is that we have not earthed any of the output terminals. The outputs are said to be "floating". This follows common commercial practice, and helps to minimize any earth loops. Of course, if necessary, either the COM or the HI output could be earthed if a particular situation called for it.

The second reason for arranging the output to be floating concerns the provisions for frequency modulation and sweeping of the oscillator. The socket on the rear (mentioned previously), connects from P1, the frequency control to pin 8, and also to the main power supply rail. The socket is normally shorted with a plug so that the frequency control is operative.

By connecting the generator to a filtered power supply, using this socket, it is possible to make a simple type of audio sweep generator. We will give details of the exact connections to be made after describing the construction and testing procedures.

The function generator chip itself, the Intersil 8038, may be obtained from the usual trade and retail sources. Alternatively, it may be obtained direct from the Australian agents, R & D Electronics, PO Box 176, Oakleigh, Vic. 3166, at a cost of $7.20 (including tax).

The only components worthy of special mention are the two pots P1 and P2. These are wire wound types, made by Philips. They have a total rotation of 300 degrees. Our frequency scale has been made to suit this type of pot, and may not be suitable with any other types. However, as this scale is linear, it should not be beyond the capabilities of most experimenters to make a suitable scale for other types of pots.

We built our generator into a small plastic and aluminium case, one of the Australian Transistor Company range. This has a folded aluminium front panel. We used the case in a rather unorthodox position, lying on its back. This gave a large panel on the top to accommodate the tuning and function controls, and a smaller front panel to accommodate the level control and the output terminals.

We mounted the printed circuit board (PCB) on the bottom of the case, using 25mm standoffs to clear the internal dividers of the case. The transformer and associated components mount to the left of the PCB.

We made a dial for the frequency control from a scrap piece of aluminium and an old knob. The lettering was done via a photographic negative and a small piece of "Scotchcal", or photo sensitive aluminium.

As the scale is linear, home constructors should have no difficulty in contriving a suitable scale.

The other knobs used were standard

items. The lettering on the front panel was made using rub-on letters, protected with a light spray of clear lacquer.

Construction of the generator should present no difficulties, as almost all the components are located on the circuit board. Once the board has been checked for possible shorts between tracks, and other similar faults, the components may be added. We used IC sockets to lessen the possibility of damage to the ICs.

Commence construction by fitting the circuit board pins and the IC sockets. Once this has been done, the smaller components can be fitted. Ensure that the diodes and electrolytic capacitors are fitted with the correct polarity. When the board has been completed, the ICs may be inserted into their respective sockets. Once again, orientation is important, so care is required.

The transformer, mains clamp and terminals, socket and PCB pillars can now be fitted to the case. Once the various switches and pots have been fitted to the front panel, the remaining wiring may be completed. Take care to ensure that the braid wiring of the shielded cable is as shown in the wiring diagram. Only the input cable to the 709 has its shield connected at the PCB, with all other shields connected together at their other ends, on the level pot and the function switch.

The front panel and the transformer chassis are earthed in the interests of hum reduction and safety. The connection to the front panel is made via a small piece of scrap metal held under one of the terminals. The transformer is earthed via a solder lug on one of the mounting bolts.

Once construction is completed, testing can commence. The first check is to ascertain that the 8038 device is funtioning correctly. Connect the output to a suitable device (RMS voltmeter, oscilloscope, stereo system etc), and check that all frequencies can be obtained, as well as the three output waveforms.

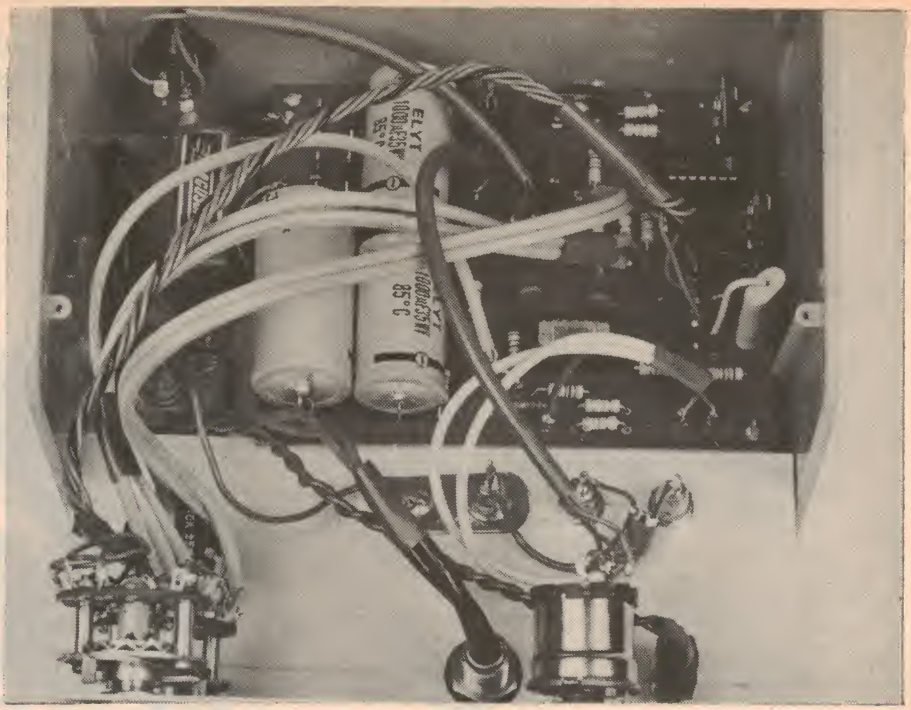
The next step is to adjust VR2, VR3 and VR4 for minimum distortion of the sine output. Ideally, this should be done with the aid of a distortion meter, although reasonable results can be obtained using a CRO or by ear. First set the frequency control to some standard frequency, usually 1kHz. Then adjust VR4 to give unity mark/space ratio, and then minimize residual distortion using VR2 and VR3. These adjustments may have to be repeated several times, to achieve a true minimum.

Once this has been done, VR1 has to be adjusted so that P1 gives a frequency variation of exactly 10 to 1. This can be done using either a frequency counter or a CRO with a calibrated timebase. First measure the highest frequency (P1 fully clockwise) and then adjust VR1 so that the minimum frequency (P1 fully anti-clockwise) is one tenth of the previous value. This will alter the highest frequency slightly, so repeat the process until the required 10 to 1 range is reached.

The final and optional step is to check and trim the range capacitors so that the range switch gives a 10 to 1 change in frequency. We found that with normal 10 percent capacitors this was not really necessary. If expense was of no concern, it would be possible to use closer tolerance capacitors.

Having completed these adjustments,

(Continued on page 107)



An interior view of the prototype showing the disposition of the major components.

LIST OF COMPONENT PARTS

1 Intersil 8038 function generator IC
1 uA709 operational amplifier IC
4 EM401 silicon diodes
1 power transformer, Ferguson PF3787 or similar, 18V secondary
1 neon pilot light assembly
1 case, Australian Transistor Company 184mm x 115mm x 118mm
4 knobs (see text)
4 25mm threaded spacers
1 mains cord clamp
1 mains cord and plug
1 3 way terminal block
1 4 pin socket (McMurdo)
2 4 pin plugs to match (McMurdo)
3 insulated terminals
2 14 pin DIL IC sockets
1 printed circuit board 75ao1

RESISTORS (¼ watt unless specified otherwise).
2 560 ohm
2 1k
1 1.5k
2 2.2k ½ watt
1 3.9k
1 5.6k
1 10k
1 22k
2 39k
1 47k
1 100k
1 180k
1 470k
1 1k trimpot
1 22k trimpot
2 100k trimpots
2 10k linear wirewound pots

CAPACITORS
1 10pF ceramic
1 220pF ceramic
1 470pF ceramic
1 0.0047uF ceramic
1 0.047uF ceramic
1 0.1uF polyester
1 0.47uF ceramic
2 1000uF 25VW pigtail electrolytics
1 2500uF 35VW pigtail electrolytic

SWITCHES
1 miniature toggle, single pole, single throw
1 4 position single pole rotary
1 3 position double pole rotary

MISCELLANEOUS
screws, nuts, solderlugs, solder, hookup wire, shielded cable, circuit board pins.
Note: resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

PULL OUT CENTRE PAGES

DICK SMITH HOBBIES NEWS

A personal note from Dick

Dear Hobbyists

Let me start by thanking the many thousands of regular customers who have helped make our business such a success. As a result of your continued support we have now grown large enough to start importing goods ourselves. This is such good news that we decided to put out this special Newsletter. As you will see from the next few pages, many lines are still at predevaluation or EVEN LOWER prices than before.

Hopefully the appearance of this Newsletter in E.A. will attract even more customers to our popular Mail Order system. When you deal with us remember you are dealing with REAL people. We too are keen electronics enthusiasts and our aim is always to give service. Of course we do sometimes slip up (who doesn't?) but our files show that complimentary letters far outnumber complaints.

I'd also like to thank the thousands of enthusiasts who have supported us in the fight to keep our industry Australian owned. All your signed petitions have been forwarded to the Prime Minister and Mr. Whitlam has sent me a personal reply. While it is unfortunate that the existing Trade Practices Act cannot be used to restore our supply of "Realistic" receivers, I can assure you that we and other Australian owned companies, are doing everything possible to regain our supply of Realistic products which we have sold in the past.

With your support and as a service to Australian enthusiasts we will also endeavour to keep supplying one-off devices like resistors instead of pre-packaging In view of the response to our other Newsletters and Special Offers, may I advise you to order early. We will hold stocks specially for Country readers. However where lines are sold out, we will try to substitute similar goods of the same value (you may return them under our usual unique satisfaction guarantee if they aren't suitable). That's the big advantage of dealing with real enthusiasts! Finally the usual plea for you to PRINT YOUR NAME AND ADDRESS and please support Australian owned suppliers. Our new motto is AUSTRALIA for AUSTRALIANS!!

Now once again it's over to you.

Dick Smith
VK2ZIP

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Spend over $20.00 Free Bell kit
Spend over $30.00 Free Motor kit

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Also at 361 Hume Highway Bankstown Tel: 709 6600

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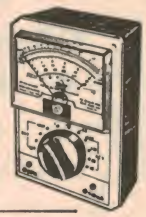
INSTRUMENTS

NEW BEGINNERS MULTITESTER ONLY $8.90



Handy little 1000 ohm per volt multitester the LT101 measures Vdc; 0-10-50-250-1kV Vac; 0-10-50-250-1kV Idc; 0-1-100mA Ohm; 0-150k. Easy to read scale. Switch operated with safety 'Off' position. Complete with test leads and battery. You must get one at only $8.90 (P & P $1.00).

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it is new!

The Mitsui has been specially designed for broadcast receiver alignment. One band covers 400 – 550 kHz for aligning IFs. Other covers 550 to 1600 kHz for MW tuning. 6 month guarantee and batteries included for only $9.95 (P & P 75c).

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Vdc: 5, 25, 100, 500, 1000. Vac: 10,50,250, 1000. Idc: 50uA, 250mA. R: 20k, 2M.

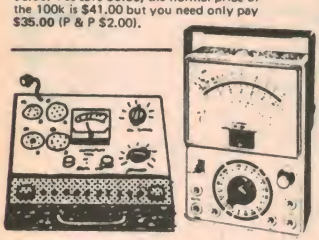
DB scale 3% dc accuracy.

Here's a good starting meter for the new enthusiast at a saving of $2.00 on normal prices. Usually $14.50. Special at only $12.50 (P & P $2.00).

Jayem 100K a high sensitivity instrument boasting 51 ranges and having an extra large 5" movement.

Vdc: 0.3, 0.6, 1.2, 1.5, 3, 6, 12, 30, 60, 120, 300, 600, 1200. Vac: 1.5, 3, 6, 12, 30, 60, 150, 300, 600, 1200. Idc: 15uA, 30uA, 3, 6, 30, 60, 150, 300mA, 6A, 12A. R: 2k, 200k, 2M, 20M.

DB scale. Outputs. 3% accuracy 100k/V dc sensitivity. This is a tremendous meter which we are reducing while existing stock lasts by $6.00. Yes save $6.00, the normal price of the 100k is $41.00 but you need only pay $35.00 (P & P $2.00).



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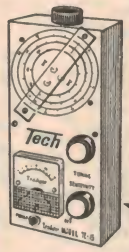
This versatile unit operates as a grid dip oscillator, an absorption wavemeter and an oscillating detector. Six plug-in coils are supplied with each unit covering the frequency range 360 Kc to 240 Mc. The unit is ruggedly constructed (full metal case) and also very light in weight. Supplied complete with earpiece, meter and full instruction manual – a must for all amateurs –



Specifications

Transistors:	3 and 1 diode
Meter:	500 uA F/S
Battery:	9 volts PP3
Dimensions:	180 x 80 x 40mm
Weight:	730 g
Frequency Range:	440 kc/s – 280 mc/s with 6 coils: A coil 0.44 – 1.3 mc/s; B coil 1.3–4.4 mc/s; C coil 4–14 mc/s; D coil 14–40 mc/s; E coil 40–140 mc/s; F coil 120–280 mc/s.

$41.50 P & P $1.00.

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If you can't get in to test your valves FREE use the TC2 to test for shorts, filaments continuity and emission. 4 popular valve bases. 15 page manual lists about 1500 valves you can check and is fitted in drawer so you can't loose it. Sturdy metal construction with large meter movement. Only $45.00 (P & P $2.00).

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MIC's

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2. Diode between base and collector (cathode). Handles 1A.
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4. Photocell – file off top and connect between E and C.
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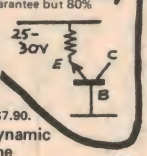
Buy a pack of 10 for $1.00 OR FREE! WITH ANY ORDER OVER $5.00 IF ASKED FOR. One pack per order WHILE THEY LAST. No guarantee but 80% should be useable as above.



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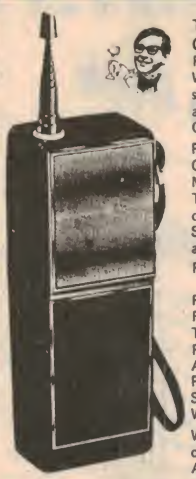
Sensitivity –48dB on 50k, –62dB on 600 ohm Sig/noise 50dB at 1kHz. Max sound pressure 130dB. Omni-directional type ECM1005 $22.50 Cardiod type ECM1015 $28.00. (P & P $1.00)



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Provision for 2 channels (27.240MHz or 27.880 MHz). Tuned RF stage. One microvolt sensitivity. Mute control. Calling tone. Heavy duty aerial. Maximum power allowable. PMG APPROVED (licence required). Transmitter effectively converts its 1W output power into a high ratio output power by high level push-pull class B modulation. Rugged case. Supplied with one set of crystals (specify frequency). Other frequency available at $7.00 pair.

Range:	up to 10 miles depending on terrain up to 50 miles over water
Frequency:	27.240 or 27.880 MHz
Freq. Stab:	0.005%
Tx:	Crystal controlled 1W
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Antenna:	13 section telescopic
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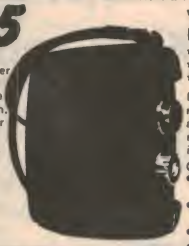

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$38 91ED Cartridge given FREE this month. Such is the quality of this deck that you will probably need a better cartridge anyway. DON'T MISS THIS SUPER SHURE OFFER.

Thorn DCR1 Dolby Cassette Deck $249

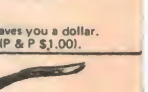
The best deck value anywhere featuring limiter to prevent overload on recording, Dolby Noise Reduction circuit, Bias switch. Blend microphone control. Separate L&R controls for line and mic. Large Peak level meters. Output level control. Multiplex filter for FM recording. Memory rewind. We could go on and on. Wow & Flutter under 0.16%. Response from 40 to 15000 Hz + 2½ dB. S/N Cr02 Dolby 56 dB etc. Terrific value for the enthusiast at $249 (P & P Freight on).

PIANOLA CAR RADIO SPECIAL $49.95

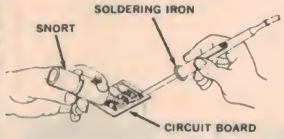
High quality SR2201 car radio features a big 7 Watt output and 5 push button pre-selector. Individual volume and tone controls. Tunes 540-1600kHz. Dual polarity at flick of switch. External aerial trimmer. This receiver is FULLY GUARANTEED for 12 MONTHS. Supplied with lock down aerial, speaker, all leads even suppressors! Easy to follow instructions. Ideal receiver for DIYers. Fornt Panle 6¾" x 2". Radio 6¾" x 1¾" x 4". Recommended price is now $89.00. We have them at only $49.95, but hurry!

FANTASTIC TAPE SPECIAL

Genuine BASF LH SM tape in C90's. Nothing but the best do not confuse with cheaper rainbow pack. Guaranteed low noise special mechanics non-jam tape. Orders may be assorted. C90SM normal list price $3.99. Our special price 10 off $2.20, 20 off $2.00. C90SM (Cr02) Chromes normally $5.60. 10 off $2.75, 20 off $2.50. P & P $1.50 for 10, $2.50 for 20.



TOOLS

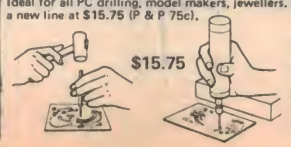


VACUUMS UP SOLDER OR LOOSE DEBRIS.

GOTTA SNORT? $3.75

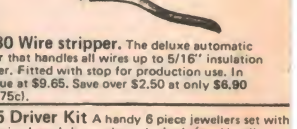
Snort is one of those hard to describe gadgets. It's made by the Soldapullt people and is called an air-vacuum pump. Hand-held like a syringe use it for desoldering, air dusting, cooling, drying etc, etc. Only $3.75.

PC drill runs off 4 UM3 cells or 6V dc at 600mA runs at 2500 rpm drilling holes from 0.0236 to 0.059". Ideal for all PC drilling, model makers, jewellers. This is a new line at $15.75 (P & P 75c).



$15.75

Chassis Hole Punch Kit Saves you a dollar. Normally $9.50 now only $8.50 (P & P $1.00).



$6.90

J 5080 Wire stripper. The deluxe automatic stripper that handles all wires up to 5/16" insulation diameter. Fitted with stop for production use. In catalogue at $9.65. Save over $2.50 at only $6.90 (P & P 75c).

J4735 Driver Kit A handy 6 piece jewellers set with free turning barrels in see through vinyl case. Usually $1.85 cut to $1.40 (P & P 50c).

$1.40

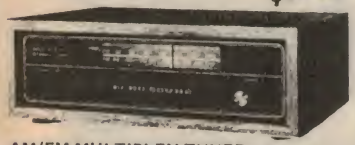
$3.50

Diamond Scriber

Fresh in from the USA — looks just like a ball point but has diamond in the nib. 6" long plastic handle. Ideal for marking PCBs and metalwork. Excellent too for cutting glass and tiles etc. Small size is ideal for confined spaces. Manufacturer claims they are used to cut IC chips!

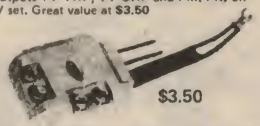
ctronics Centre

Was $75 **SCOOP!** $65 only



AM/FM MULTIPLEX TUNER There is a shortage of tuners so get your's early. On Separate AM and FM front ends. 10 transistors, 14 diodes. FM 88 to 108MHz, AFC, 60 dB S/N, 35 dB sep, 600 mV output AM 535 to 1605kHz, ferrite rod, Multiplex adaptor built-in with indicator. 240V operated in Walnut case. Guaranteed 12 months. Only $65 (P & P Free). Hurry, demand is going to be heavy.

FM splitter. This one is a beauty. Splits incoming 300 ohm TV aerial lead giving outlet for FM tuner. In fact 3 outputs TV VHF, TV UHF and FM. Fits on back of TV set. Great value at $3.50



$3.50

SP620 speakers with 8" high compliance woofer and 2" tweeter with horn duct for better dispersion. Response from 60-16000Hz 16" x 11" x 7" approx. Handles 15W. Smart finish. Would be worth at least $30 but your's for $24.50 (P & P freight on).

$24.50

$14.95

TK700 Cube speakers handle 10W with a response that has to be heard to be believed. Has 8 ohm full range 5" speaker with 1½" voice coil throwII Response from 45 to 18kHz thanks to huge 3" magnet yet measures only 6" cube. Available in red, black or white (specify). Ideal extension or 4 channel rear unit or for budget hi-fi Only $14.95 each (P & P freight on).

INTERCOM TELEPHONE PICK-UP 75c

Easily fitted by suction pad. No connections, uses inductive pick up. Ideal for recording conversations on your cassette machine or feeding into amplifier for all to hear. With plug and 36" lead to fit most recorders. Get best results near back You must have one at only 75c.

BOOKS

IT'S GREAT OVER AT THE PAGE!

LATEST SHIPMENT JUST ARRIVED!

NATIONAL LINEAR APPLICATIONS MANUAL $3.00

Handy reference manuel giving fully indexed cross references on linear IC applications both monlithic and hybrid. Individual notes cover operation and use of particular devices or different methods of accomplishing functions. Detailed subject cross reference covers 1200 details in text. Hundreds and hundreds of diagrams. Well over 200 pages. NOT A BEGINNERS BOOK $3.00. (P & P 75c).

HOW THINGS WORK VOLUME 2 OUT NOW $5.95!

Another 600 pages of easily understood explanations of machines. Volume 1 has been a sell out. Now Volume 2 tells you about a whole lot more — how colour TV is transmitted, why is dry cleaning called dry, how does a computer compute. Ideal for the layman and anyone with inquisitive kids. Covers the simplest household gadget through to radar and jet engines.
We have special stocks of both volume 1 and 2 at $5.95 each or get the pair for $11.50 (P & P $1.10 per volume $1.50 pair).

Reference Data for Radio Engineers
(1196 pages). This massive book contains everything you need to know. Over 1½ million copies sold all over the world. Contributions from 100 leaders-in-their-fields, engineers, professors, government experts and staff of ITT. 45 chapters, 100s of charts, nomographs, diagrams, curves, tables, pictures. Yes there's 1196 pages full of everything. We have a large quantity of the latest edition still at $26.50 post FREE. Postage is normally over $2.00 because it's so heavy!

NEW ARRL HANDBOOK IN
Latest edition has more Tx and Rx circuits than ever before plus half-size 20M Yagi and 5 element cubical quad. New updated chapters on many subjects. First shipment due end of January at $7.50 (P & P $1.001.

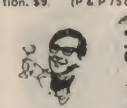
COLOUR TELEVISION THEORY
G. Hutson, 326 pages. This book assumes the reader to have a working knowledge of monochrome television principles. It deals almost exclusively with the PAL system, but a chapter is devoted to the NTSC system. The text begins with an easy read chapter on "light" physics to give the reader a basis on colour mixing, chromaticity diagrams etc.) the principles are dealt with step by step in an easy to understand form. Practical circuitry and diagrams accompany the text, to give an interesting explanation. Colour plates are included to show relevant colour information. A chapter is devoted to transmission, and describes the difference between PAL, NTSC, and SECAM. In all, a complete, thoroughly absorbing easy to read text. This book is not only a must for all television technicians but of enormous interest and value to all interested in colour television. **We are getting entire Australian shipment, so this book is virtually available only from us. $12.50.**

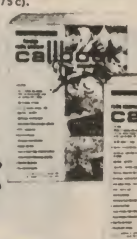
Don't miss out on Callbooks. 1975 edition due Mid 75 — expected price $12.50. We still have the 74 edition at $9.00 each or $16 a pair (75 pair will probably cost $25!!)

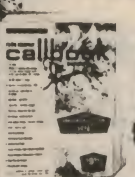
US RADIO AMATEUR CALLBOOK lists 283,000 K and W calls in over 600 pages. Covers all States and US citizens overseas $9 (P & P 75c).

FOREIGN RADIO AMATEUR CALLBOOK is the companion volume listing over 211,000 amateurs outside USA. Also has a useful selection of info. Over 400 pages give full address information. $9. (P & P 75c).

BOTH CALLBOOKS FOR ONLY $16.00







FREE BELL KIT WITH ORDERS OVER $20

Lenk Cordless Iron
The BP100 is the greatest development yet. Runs off a rechargeable cell giving up to 120 joints per charge. Press the button for soldering heat in only 5 seconds plus built-in working light.
Ideal for use on cars, caravans, boats etc. Anywhere you can't trail mains leads. Serviceman's dream. Ideal for CMOS and delicate IC circuits since there are no earth leakage currents. Only for electronic soldering (won't mend kettles!). Iron complete with tip at only $19.95. Mains charger BP100AC only $10 or build a 6V or 12V car charger for only 50 cents (P & P $1.00) 90 day guarantee. Spares available.

SPECIAL MAGNIFYING GLASS for readers of DickSmith adverts. 3" diameter. DOESN'T ENLARGE PRICES!! ONLY 95c

ICOM IC22 SEE E.A. DEC. 74 $199

Icom IC22 144-148 MHz, FM transceiver has power outputs of 1W and 10W. The 22 channels all have separate trimmers. Deviation 5-15 kHz. Features solid state Tx/Rx relay, large built-in speaker, MOSFET front end with 5 helical filters, noise cancelling mic., quick disconnect mobile mount. And if the spec doesn't greb you, the looks will. Soft green back lighting, special transmit light and even a light to tell you of incoming signals if the volume is turned down. Supplied complete with workshop manual and accessories right down to a silicone cloth to keep the set like new.
Fitted with one set of crystals (146.5). Normal price is $245.00, but we have a shipment coming in at $199.00 (P & P Insured freight for $3.50). Crystels are also available at $9.00 a pair as follows:

New Channels	42/45	146.1	146.7
	48/60	146.4	147.00
	50	146.5	146.5

PARTS

$4.75
$4.00

$1.00

Hard to get Vernier Drives back again.
No price increase yet on 7660 vernier drives, 70mm diameter still $4.75, 50mm still $4.00.

D7C 4mm Banana Terminals in Red and Black. Normal price 50c each. Mixed pack of 10 for only $2.50. (Yes 25c each!!) (P & P 50c).

6 foot DIN-DIN extension leads Save 50c normal price is $2.75. Now only $2.25

$2.50

$2.25

6 foot DIN-4RCA plugs again saves you 50c. Normally $3.00. Now $2.50

FREE MAGNET KIT WITH ORDERS OVER $10

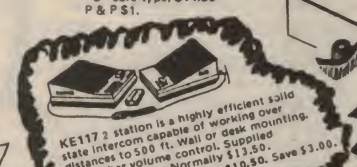
Huge Savings on Special D.S.E. "EICO" Transformers
Manufactured for Dick Smith Electronics. Full satisfaction guaranteed.

DSE 2851 240V AC at 12.6V at .15A centra tapped
Normally $6.50 **Special $3.50** P&P 50c — **$3.50**

DSE 2155 240V AC to 6.3, 7.5, 8.5, 9.5, 12.6, 15V at 1 amp — an ideal multi purpose power transformer.
Normally $6.50 **Special $4.75** P&P 50c — **$4.75**

DSE 6672 240V AC to 30, 27.5, 24, 20, 17.5, 15 or 30V C.T. at 1 amp.
Normally $11.00 **Special $6.50** P&P $1 — **$6.50**

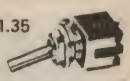
DSE GIL-2 240V AC to 18 volts at 6 amps. Designed for 13.8 volts DC power supplies and battery chargers — new "C" core type. $14.50 P & P $1.



KE117 2 station is a highly efficient solid state intercom capable of working over distances to 500 ft. Wall or desk mounting. Master has volume control. Supplied with 50 ft. cable. Normally $13.50. 100 only reduced to only $10.50. Save $3.00.

MS174 DPDT switches rated at 3A, only $1.35.

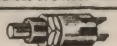
$1.35



2" and 2½" speakers (specify). A super special 8 ohm, ideal for transistor radio replacement giving good sound at ridiculous price of only $1.00 (P & P 50c).

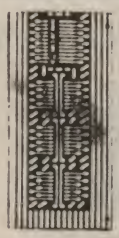
$1.00

J4814 Morse Key for the Novice (get our electronic kit for your practice set). 5" key bar 1" knob. We sold hundreds at $1.50. Now cut to $1.00 (P & P 50c).

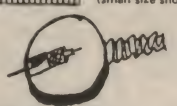


it's NEWS!!!

MS102 Push Button switch
SPST takes 7mm hole. Usually 45c each in packs of 10 for $2.50 (P & P 50c).

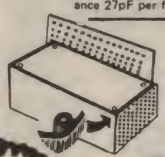


MULTIDIP P.C. BOARDS $2.00
Knocking up prototype boards for IC projects is a bit of a headache. So here are 2 boards to save time and sweat. Big one takes up to 8 x 14 pin or 16 pin DIL devices or 6 plus 2 x 18 or 24 pin (latter may have 0.3 or 0.6" spacing). Half size version available. Undrilled but holes clearly marked. Easily fit 32 wey edge connector (large) or 16 wey (half size). Well worth $2.00 each large, $1.00 half size (P & P 50c) (small size shown)



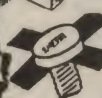
MICRO COAX!

Miniature Coax
Less than 0.1" diameter high quality coax for wiring miniature transmitters etc. etc. Handles power to 120W, 50ohm impedance 27pF per foot. Only 25c/ft.



ZIPPY BOXES
Here's the boxes for project builders who want a real professional look to their projects. These boxes are moulded in ABS, so they are tough yet easy to drill. The finish is a posh black with ingenious posts in each corner to take self tapping screws and hold a printed circuit board. They are supplied with a flush fitting aluminium panel which fits all ways round (such is the precision of these boxes). Special panels are also availeble made of bakelite at 50c and matrix boerd at 80c (large size only).

Size UB1 15 x 9 x 5 cm $2.00
Size UB3 12½ x 6 x 4 cm $1.65

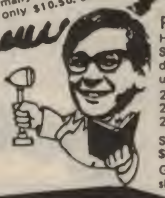


R.F. POWER TRANSISTOR SPECIAL
Huge pre-devaluation purchase of R.F. power transistors from Solid State Scientific enables us to REDUCE prices on these devices. Fully guaranteed, premium quality devices at savings up to $2.00 each.

2N5589 7W was $6.50 NOW $4.90
2N5590 15W was $7.75 NOW $6.90
2N5591 30W was $9.85 NOW $7.50

Set of 3 to give complete chain (see Kits) was $22.50 NOW $19.25.

Get together with your friends (or club) bulk purchase and share the savings.



AMATEUR's

OSKER BLOC SWR200 Professional SWR Power Meter

At last a truly professional instrument for the keen Amateur. Uses the THROUGH-LINE principle. Covers 3 MHz to 200 MHz (guaranteed) with inbuilt changeover for 52 or 75 ohms U.H.F. Connector. Each unit is INDIVIDUALLY calibrated with its calibration chart attached to the instrument. Four power ranges cover 0-2W, 0-20W, 0-200W and 0-2 kW.

Measures VSWR 1:1 to 1:10 and ∞.

This is the first instrument of its kind under $100. Hurry your order, first shipment of 50 units at only $48.50 (P & P $2.00).

Only $48.50

Professional THROUGH-LINE SWR & POWER to 2kW

SPECIFICATIONS

SWR Meter

Type:	Directional Coupler
Ratios:	1 : 1 to 1 : 10 & ∞
Frequency Range:	3 MHz to 200 MHz
Impedance:	75 ohms & 52 ohms
Full Scale Minimum Power:	50W at 3.5 MHz 15W at 7 MHz 5W at 14 MHz 2.5W at 21/28 MHz 0.5W at 50/144 MHz

Power Meter

Type:	Through Line
Powar Ranges:	0-200W, 0-2kW at 3.5 MHz 0-20W, 0-200W, 0-2kW at 7/14/21MHz 0-2W, 0-20W, 0-200W, 0-2kW at 28 MHz 0-2W, 0-20W, 0-200W at 50/144 MHz
Accuracy:	±15% at SWR 1 on Center
Safety Rating:	2kW at SWR 1.1–1 750W at SWR 1.5–1 200W at SWR 3.0–1
Meters:	95uA D.C.
Connectors:	UHF Type (SO-239)
Dimensions:	76m/m high X 110m/m deep X 220m/m wide (3" high X 4-3/8" deep X 8-5/8" wide)

DON'T FORGET! HAM NOTEBOOK
A continual best seller, HAM NOTEBOOK in just a few short months has well established itself as an important part of any amateur's library.
This book is taken from the best of HAM RADIO's popular Ham Notebook section and has a wide variety of short ideas and projects on virtually every phese of amateur radio. $4.50.

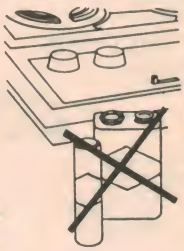
PLUG PACK BATTERY ELIMINATOR $6.50

Handy little unit is little bigger than mains plug. Will drive any 6V calculator or radio etc. requiring up to 100 mA. Fitted with coaxial type plug. 240V operated and fully approved. (P & P $1.00).

240V:110V transformers

Ideal for running US equipment or anything requiring 110V: 30W $20.00; 60W $24.00; 100W $30.00 (P & P $2.00).

½ Amp REGULATED POWER SUPPLY



Famous A & R deluxe high current model which delivers ½ amp fully regulated at 6, 7.5, 9 or 12V. Rugged metal case. Voltage selector and polarised output $38.70 (P & P $1.00).

All converters described here completely eliminate the need for batteries in transistorized equipment.

'600' Regulated power supply delivers 3A (5A peak) at 12V. Ideal for running car radios etc. off domestic power. On-off switch, neon indicator, 7mV rms ripple etc. Great value at only $32.00.

3 way car converter Fits car cigarette lighter and gives 6,7.5 or 9V at up to 300mA. Supplied complete with polarity reversing extension cable and 4 way plug-socket adaptor which fits almost everything you'd need it for. Converter alone is usually $5.50. Get converter and adaptor lead for only $4.90 (P & P 75c).

sinclair SCOOP!

PROJECT 80 only from us

only ¾" deep x 2" high the slimmest, most elegant hi-fi modules ever made

FM look

Project 80 FM tuner and stereo decoder

- Twin dual varicap tuning: 4 pole ceramic filter: switchable A.F.C.
- On the decoder, solid state stereo indicating beacon.

Making the Project 80 F.M. tuner and decoder available separately gives a wider choice of systems and saves money where stereo reception may not be required. The tuner is a triumph of electronic design and assures excellent performance. The decoder gives a 40dB channel separation with 150mV output per channel. Both units may be used with other than Project 80 systems.

TECHNICAL SPECIFICATIONS OF TUNER
Size – 85 × 50 × 20mm (3⅜ × 2 × ¾ins)
Tuning range – 87.5 to 108 MHz
Detector – I.C. balanced coincidence for good A.M. rejection
One I.C. equal to 26 transistors
Distortion – 0.2% at 1 KHz for 30% modulation
4 pole ceramic filter in I.F. section
Aerial impedance – 75 Ω or 240-300 Ω
Sensitivity – 4 microvolts for 30dB quieting
Output – 300 mV for 30% modulation
Power requirements – 23 to 33 volts
DECODER
Size – 47 × 50 × 20mm (1⅞ × 2 × ¾ins)
One 19 transistor I.C.

Mono FM Tuner **$34.50**

Decoder for above $21.00

Project 80 active filter unit

Makes a highly desirable part of any worthwhile system where inputs may be from record, radio or tape. As with Stereo 80, separate controls applied to each channel make it easier to obtain ideal stereo balance.

- For scratch and rumble control
- Transistorised active circuitry

TECHNICAL SPECIFICATIONS
Size – 108 × 50 × 20mm (4¼ × 2 × ¾ins)
Voltage gain – minus 0.2dB
Frequency response – 36Hz to 22KHz controls minimum
Distortion – at 1KHz – 0.03% using 30V supply
HF cut off (scratch) – 22KHz to 5.5KHz, 12dB/oct slope
L.F. cut off (rumble) – 28dB at 20Hz, 9dB/oct slope

$34 *Stereo 80 Filter* $19.50

Stereo 80 pre-amplifier and control unit

- For P.U., radio and tape
- Tape monitoring switch
- Simplest ever fixing

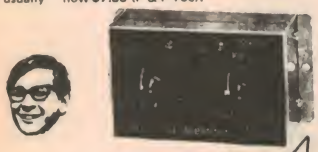
Each channel has its own separate tone and volume controls operated by sliders, enabling ideal environmental matching to be obtained. A virtual earth input stage forms part of the up-dated circuitry that ensures the finest possible quality from all signal sources. Generous overload margins are allowed on all inputs. Clear instructions with template are supplied.

TECHNICAL SPECIFICATIONS
Size – 260 × 50 × 20mm (10¼ × 2 × ¾ins)
Finish – Black with white indicators and transparent Sliders
Inputs – Magnetic pick-up 3mV RIAA corrected; Ceramic pick-up 300mV
Radio 300mV; Tape 30mV
Signal/noise ratio – 60db
Frequency range – 20Hz to 15KHz ± 1dB. 10Hz to 25KHz ± 3dB
Power requirements – 20 to 35 volts
Outputs – 100mV + AB monitoring for tape
Controls – Press button for tape radio and P.U. Sliders for volume, bass (+ 12dB to – 14dB at 100Hz) treble (+ 11dB to – 12dB at 10KHz)

These modules are only available from us. Send for the special 32 page Stereo 80 Handbook which gives full description of modules, systems, circuits etc. Only $1.00.

MODULE PRICES (P & P $1.00)
Z40 power amp $17.00
Z60 power amp $21.00
PZ8 Power Supply $24.50
Transformer to suit 40V @ 2A (5755) $11.50 *(P & P $1.50)*

J1194 Resistance-capacitance substitution box. 12 steps each in 2 ranges 15 ohm to 10k and 15k to 10 Meg plus capacitance from 0.0001 to 0.22uF (600V working). Handy unit for the experimenter. $7.90 usually – now $7.50 (P & P 75c).



FREE TRANSISTORS WITH ORDERS OVER $5

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NEW XL250 COMBINED HOME ALARM MODULE $24.50

Easy to instal module from the makers of Carguard. Features low current drain, built-in Siren driver, auto-reset after 10 minutes (to save batteries). Use with Open and Closed sensors. Unique programming feature allows delay on ANY exit/entry so alarm can be set before you leave home $24.50 (P & P $1.00).

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Circuit Tape 36 yd x ¼" $2.40
Tape blocks pack of 10 $2.00
Reed Switches each $1.90
DPM Pressure mat 30" x 20" $11.50

KITS

KIT CLEAROUT (ALL P & P $1.00)

Well worth buying for parts alone. Don't write in about them, they won't last!!

ETI 1 transistor radio	4 only @ $10.00
6 Metre Converter	4 only @ $13.75
Spring Reverb (less spring $19.50 extra)	3 only @ $17.50
ETI Super Stereo	5 only @ $19.00
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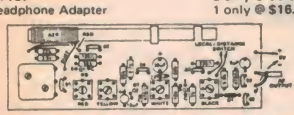
Courtesy Light	9 only @ $3.50
B.F.O.	2 only @ $6.00
Headphone Adapter	1 only @ $16.50



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MORSE CODE TRAINER $3.25

only needs a key and 9V battery. Specify speaker or earpiece. Ideal for budding amateur at only $3.25.

STROBE KIT (ETI AUG 71) $26.50

ideal for parties or discotheque etc. Flash rate variable from 1 to 20 flashes per second. Mains powered. Complete $26.50; Reflector only $5.00 (P & P $1.00) 6.5 uF, 250V caps $2.95.

ETI Push button dimmer (NOV 74)

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Based on 555 timer provides a signal after ½ hour, 1 hour or 2 hours so you have time to dash back before picking up a ticket. Soon pays for itself. Electronic parts only $17.50.

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- *Operates on 240V mains 50 or 60 cycle*
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- *Full circuit board supplied*
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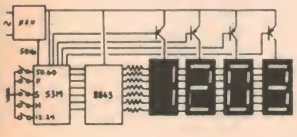
- *'Seconds' readout can be easily added*
- *Power supply included – no extras*
- *Uses brand new National ICs and semiconductors. Spares are available.*

Kit includes the following:
2 ICs, 4 readouts, 4 driver transistors, PC board, transformer, pushbuttons, resistors, diodes, capacitors, etc. NOTHING MISSING except a case which you can easily make yourself or use one of our zippy boxes.

Special Seconds Readout requires only two transistors, two readouts to make a full 6 digit clock. No extra wiring since circuit board has provision for expansion. Special price for seconds kit is only $6.00.

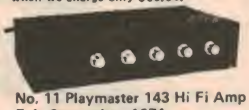
Short form kit for the budget conscious contains all semi's and instructions you simply add common components and use veroboard or etch your own PCB. We've cut this one to the bone at $19.95.
Still can't believe it's this cheap? Well send a stamped self addressed envelope and we'll send you the instructions.

No, not the usual $59.00 but a complete kit for only $29.95 using top quality National semiconductors. Even the basic beginner can build one in under an hour following our simple instructions. Full money-back guarantee so why not buy one, inspect it at home for 7 days and if not satisfied return the kit and we will refund your money.



143 now $69.90

HUGE PRICE BREAKTHROUGH
Because of direct importing of expensive components like the transformer we can reduce the price of the Playmaster 143 by nearly $10.00.
Now only $69.90 plus $3.00 P & P — every top quality part supplied inc. magnificent metal front panel (fully silk screened). Yes — why pay $75.00 when we charge only $69.90.



No. 11 Playmaster 143 Hi Fi Amp E.A. September, 1974

This unit is an improved version of the Playmaster 136 of which over 10,000 have been made. 12½ Watts per channel into 8 ohm at a typical 0.4% THD and within 32dB from 20HZ to 20KHZ. Inputs are 2mV into 50K and 150mV into 500K. Noise figures 60dB down with all input open and 44dB X talk. An excellent unit which has been designed so that conversion to 4 channel can be made with a minimum of fuss. Ideal for the home environment and has provision for headphones.

Speaker Specials

These two cabinets feature real timber veneers (not plastic) and foam black grills for good sound dispersion.

2 Speaker 2 way has an 8" woofer and 2" tweeter giving response from 40 Hz to 20 kHz. Only $89.00 a pair (P & P Freight on).

3 Speaker 3 way system features a 12" really heavy duty woofer plus 6" mid range and dome tweeter. Tremendous bass from this one. 30 to 25 kHz and full 35W rms handling. Only $140 (P & P Freight on).

CALL IN AND HEAR THEM.

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RESISTOR PACKS

Compiled from Philips computer listing of usage. Definitely not the usual useless pack with 2 or 3 of every value like 33 ohm, 18k etc. In our's you get 20 x 1k and only 2 x 56 ohm. However there's at least 2 of every value from 22 ohm to 470 k. Over 50 different values and 260 ¼W, 5% carbon film resistors. Normal value over $8.00. You get over 260 resistors for only $6.50.

CAPACITOR PACKS

Here is our first computer listed pack of single ended electros. 42 top quality caps based on usage (not the useless values). Check what you get:

10V 2 x 33 uF
16V 4 x 100 uF, 4 x 220 uF, 2 x 470 uF
25V 4 x 2.2, 4 x 4.7, 4 x 25, 2 x 33, 4 x 47, 4 x 100, 4 x 220, 2 x 330, 2 x 470

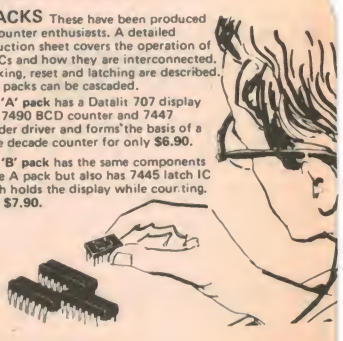
You see it's not a random pack but based on computer usage listing. CAP1 pack has 42 electros for only $7.90. Normal value is around $12.50.

DIGIPACKS

These have been produced for counter enthusiasts. A detailed instruction sheet covers the operation of the ICs and how they are interconnected. Clocking, reset and latching are described. Both packs can be cascaded.

TTL 'A' pack has a Datalit 707 display with 7490 BCD counter and 7447 decoder driver and forms the basis of a single decade counter for only $6.90.

TTL 'B' pack has the same components as the A pack but also has 7445 latch IC which holds the display while counting. Only $7.90.



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Forum

Conducted by Neville Williams

Out with ballot boxes. In with what?

If a reader from Victoria was to have his way, the traditional ballot box would be a thing of the past. Referenda on public issues would be conducted electronically with a minimum of notice and much of the mickey would be taken out of trade union disputes. Even companies could solicit the opinions of shareholders on urgent matters by renting time on the facility he has in mind.

The idea, the equipment, is seen as a panacea for many of society's present ills and this is how it is introduced:

Dear Sir,

I wish to offer society a serious proposal for an electronic voting system which could bring democracy much closer to the people. It would be versatile and, in the long run, cheaper than the present neolithic method of collecting votes.

The ordinary press isn't interested because two attempts to have the idea published have failed. I am therefore publishing it myself by sending copies of the original to people in various walks of life.

If the idea catches your interest, I invite you to discuss it in "Forum" to gauge public reaction.

It makes no difference whether the method of assessing votes is preferential, first past the post, or the French system (which I think is the best). This idea is concerned only with collecting votes, not interpreting them.

M.F. (Glenroy, Vic)

The original text is much too long to warrant reproducing in full but M.F's proposal for an electronic voting system can be summarised under appropriate sub-headings.

BROAD PROPOSAL: An electronically based system by which members of the public could register votes, opinions, protests, &c through automated access booths installed in all population centres throughout the nation. Incoming data would be validated, classified and summed in centralised computer installations.

NAME: Provisionally E.I.D. for Electronic Instant Democracy. Maybe E.V.C. is better for Electronic Vote Collecting.

TECHNICAL BASIS: The necessary technology is available. It needs only a little imagination to take a computer and a magnetic card and join them in a way that will make a major dent in the tensions of life.

ACCESS: Every major street corner would have a booth like a public telephone. You would enter, read the current question on a small TV screen, insert your personal voting card in a slot and enter your vote by pushing one or more buttons. The TV information display could be carried to the booth by slow scan television on ordinary telephone cables. Beyond the "black stump" there could be solar powered booths controlled by radio. The booths could be accessible 24 hours a day and, unlike public telephones, they would be vandal proof.

VOTING CARDS: Every eligible person would be issued with a plastic plate carrying an individual magnetically recorded number. Lost cards would be reported, then duly replaced by a new card carrying a new number. The original card would be rendered invalid by programming the computer to reject the particular number. In the normal way. The computer would record who had voted and the total vote but would not record the nature of individual votes.

ELIGIBILITY: People eligible to vote in state and federal elections would be included automatically but, if the system was extended to cover wider issues, other citizens could be issued with cards. It would be a simple matter of programming to restrict these further cards to issues to which they were appropriate.

SECURITY: E.I.D. would eliminate fraud, as by double voting, and other irregulatities. It would be next to impossible to cheat the computer.

ORDINARY ELECTIONS: If considered desirable, booths could be connected to computer centres in Canberra or in state capitals, or elsewhere, depending on whether the election was federal, state, or local.

REVIEW: The function of reviewing legislation could pass from the upper house direct to the electorate itself, which would be able to veto any unacceptable legislation instantly through E.I.D. Similarly, an immediate answer could be obtained to referenda questions.

OPINIONS: E.I.D. facilities could be rented so that political parties could test voter opinion trends instead of relying on "intuition" or "judgment". Commercial interests could conduct quicker and wider surveys and opinion polls. Universities would be able to use the facilities for social research. Companies could secure verdicts from their shareholders, &c.

BUREAUCRACY: Too many people suffer at present "for the good of the whole". E.I.D. would make appeals to the people easy and help restrain our present day "tea cup tyrants".

STRIKE BREAKING: E.I.D. would make secret ballots cheap and simple in relation to the election of union officials, as well as determining the majority will in regard to impending strikes.

The article by M.F. concludes thus: "As individuals in a mass society we feel so helpless. We are beset by problems but often can't do anything except write a letter to the press or government and hope that our seed will take root in the largely unfertile ground, which is the only ground available to most of us.

"E.I.D. could be a safety valve for pent-up tensions that might otherwise explode in the violent acts of individuals.

"The silent majority needs a voice. E.I.D. would provide it!"

Well now, M.F. is obviously somewhat upset and disillusioned because he has not succeeded in having his article published to date, and even we have merely summarised it. I think he faces two main problems:

The first is that the concept, at least on the proposed scale, is way ahead of its time. As he says, it would be technically feasible to develop such a scheme and, in fact, token fragments of it are already in operation in the way of chamber voting systems, audience reaction systems, bank cards, and so on. But it would be a very bold politician indeed who would currently be prepared to sponsor the enormous capital outlay for a system capable of handling a federal election, let alone the extras. "Cheaper in the long run" is not always an acceptable reason for expenditure right now.

We're not likely to see an automated, electronic voting system until the practical—not philosophical—need for it is so obvious to the public that they will support the expenditure. But, of course, there has to be visionaries and pioneers and M.F. is filling that role.

The other thing that is operating against M.F's article is his complete enthusiasm for the plus factors, his unconcern with possible objections and his tacit assump-

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tear out for future reference.

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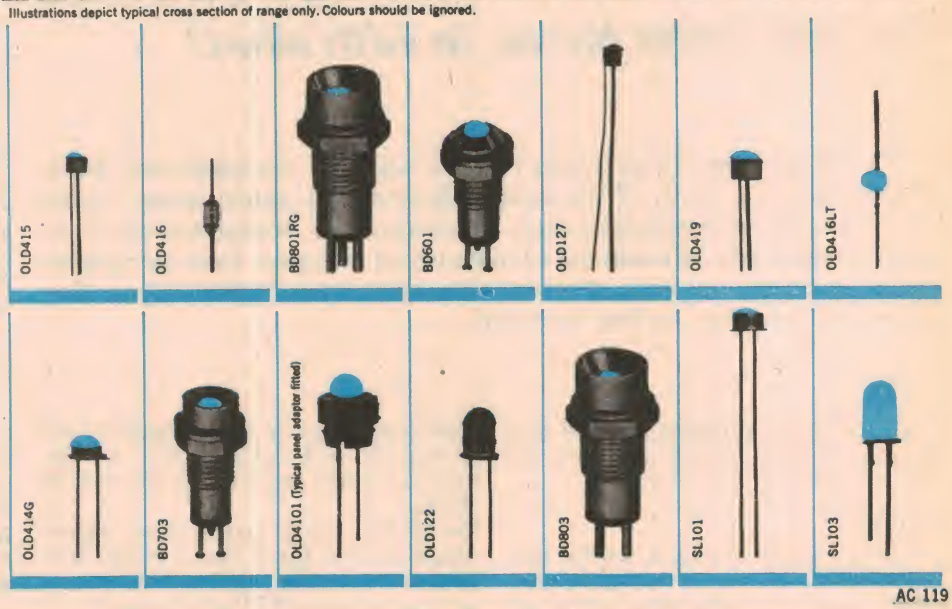
Illustrations depict typical cross section of range only. Colours should be ignored.



AC 119

Which man are you?

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Sophisticated solid state components, multi-layer and high density circuitry as found in colour TV, industrial instrumentation etc. need the controlled temperature, slim profile and high power of the mains voltage THERMATIC.

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tion that the things he wants to accomplish are automatically the best things for the community.

It may not come through in the summary to anything like the same extent but, to read the original text, is to be confronted by almost automatic problems which M.F. seems to be unaware of. This largely discounts the whole effort and fates it almost automatically to be confined to the waste paper basket.

Take, for example, the matter of security. M.F. says "It would be next to impossible to cheat the computer". These are his actual words, not mine. The clear implication in that, with E.I.D., voting discrepancy in all forms would become a thing of the past.

It is true that the present system is open to a certain amount of irregularity: voters listed at old and new addresses simultaneously, names of deceased not removed, and so on. Many of these errors are due to lack of communication or faulty communication and this would affect the issue of cards in much the same way as it now affects the inclusion or otherwise of names an a printed roll.

An extra factor would be voting cards, which are "things"—liable to be lost and found, misused and falsified. It certainly doesn't follow that the overall error factor with cards would be less than the present system. It could be the reverse.

There is one other aspect that should be considered—having to do with deliberate "rigging" of an election.

It is conceivable that, under the present system, a dishonest local official may falsify his local vote count and get away with it. But, for this to happen in a large scale would involve so many people that the plot would almost certainly be exposed.

By contrast, electrical impulses into a computer are intangible and even highly skilled "scrutineers" may fail to detect a cunningly hidden routine in a highly complex computer operation. On a national scale a contrived bias of only a couple of percent could unseat governments or radically change policies.

Against such a possibility, an occasional dishonest local official, or discrepancies in the electoral roll would be trivia.

Again M.F. sees his system as a "cheap and simple" answer to excessive union militancy by the simple introduction of a secret ballot of all the relevant union members. What he totally ignores is the plain fact that unions will not accept secret ballots for many of their decisions. In this context and, as matters stand, E.I.D. is neither cheap, nor simple, nor is it an answer!

Behind some of the other suggestions is a tacit assumption that members of the public have a mature and stable view of matters generally; that they are favourably placed to give a considered verdict within the brief time period made possible by E.I.D. which, I would remind you, stands for Electronic Instant Democracy.

In truth, the public's view of many matters is emotional and unstable and an instant vote is likely to reflect the emotions of the moment rather than the needs of the future. The protracted attack and counter-attack of the present "neolithic" system has many unfortunate facets but it does force people to think a little bit, over a period of time, and offer something more than a snap judgment.

In fact, resourceful management of a country or a business sometimes requires those in charge to take measures which are unpopular at the time but which are designed to produce a tangible and evident benefit before the day of reckoning—whether it be an election or a meeting of shareholders. With E.I.D. the unpopular measures would never stand a chance.

In short, while it may be handy to get "instant", even if emotive reactions in some situations the very existance of the facility might endanger rather than enhance democracy in the broad view because it would inhibit any longer term planning which involved unpopular short-term measures.

Here's another possible danger to democracy. It would be a simple matter to obtain a printout of all those who voted in an "inconvenient" manner!

One of these days, electronic voting and vote counting may become a reality, because of advancing technology and despite the enormous outlay involved. But, en route, a great many philosophical questions will need to be debated including the very concept of "instant democracy".

As a phrase in an article it sounds fine. Now try this one: "spur of the moment democracy". Ugh!

But let's be fair. M.F. has pointed up a problem which is very real, and most of us too have shared, at times, his feelings of frustration. He has suggested a solution to that problem which we have criticised on a number of grounds and it may have to go "back to the drawing board". But, as someone in the office remarked when they read M.F's letter: "At least he's trying to be constructive, rather than simply rebelling and throwing bombs around!"

LIKES SIMULATED 4-CHANNEL SOUND

It is over 20 years since I last wrote to you and, at the time, I had not been in Australia for long. I have purchased your magazine every month during this time and have mostly found it interesting, informative and well presented.

I am writing to comment on the latest audio gimmick (?) namely 4-channel sound. It is a pity that there is not more agreement among manufacturers as to what system to adopt, as it would make matters a lot easier.

Even so, a matrix record played through the wrong decoder still sounds quite good so maybe it does not matter too much.

I had a reasonably good stereo outfit and decided to go 4-channel, but I had to do so within my very limited means. I had tried the out-of-phase loudspeakers, which is quite good, but I figured I could do better. So I purchased the kit for your Stereo 24 Adaptor, plus a couple of IC's for the rear power amplifiers. This, plus a volume control cost me about $20.

I managed to fit them into the existing cabinet and to power them from the same supply.

I am quite pleased with the results as the 24 Adaptor gives quite good decoding of matrix records, with good front/rear separation. I can recommend it to anyone who wants 4-channel without too many complications.

Having enjoyed 4-channel, I don't think I would ever want to go back to 2-channel, as the improvement even in ordinary stereo records is quite marked.

Finally, just one thing I have noticed in record shops lately: some of them are displaying Decca phase-4 stereo records with quadraphonic records, thus adding to the general confusion.

Thank you for a lot of enjoyable reading in the past and—hopefully—well into the future.

J.R. (Cowandilla, SA)

To change the subject, the letter in the above panel raises three points.

The first is that we do get encouraging letters—lots of them, in fact, and we're grateful for them! Readers may get the reverse impression because the ones we publish tend to be those which reflect trouble or criticism and which invoke public acknowledgement.

The second point is J.R's contentment with our Stereo-24 Adaptor and his initiative in building it right into an existing stereo amplifier, along with a couple of power ICs. It's the kind of scheme which provides an extremely neat answer but, of course, it demands an enthusiast with adequate knowledge and an amplifier which is technically "hospitable".

Finally, the confusion between phase 4 records and quadraphonic. It's understandable but one would think that people who work in record shops would show a little more product awareness than that.

It raises another point: a report from UK indicates that one record company at least has been markering matrix quadraphonic records with ordinary stereo labels, to avoid the need for duplicate dies, &c. Hopefully, 2-channel buyers would never know that they were really playing a 4-channel compatible disc.

One recalls the occasional 2-channel stereo disc that has seemed to decode superbly. We've regarded it as an accident but who knows? Some such discs may well have been matrixed pressings parading under a "stereo" label.

The Serviceman

Don't let this happen to you!

In the life of most servicemen there are occasions—fortunately rare—when you feel like literally kicking yourself; when the obvious has been overlooked; or lack of attention to detail has led you on a wild goose chase. The only consolation is that it probably sharpens our wits for a while.

This is a story about a fairly old model TV set with several faults—one of them a real stinker! To be honest, I walked into a trap of my own making—at least in part—but that doesn't make the experience any less traumatic.

The set belonged to a totally deaf couple. In fact, I had sold it to them in the early days of TV, the sale arising out of my having sold a similar model to one of their relatives, who was a regular customer.

I imagine most readers would immediately query the value of a TV set to deaf people; in fact I queried it myself when I first encountered the situation. The truth is, I suppose, that events portrayed on TV, without sound, do not differ greatly from events in real life, without sound. To the extent that deaf people learn to cope with real life—and most of them cope very well—they appear to cope with TV.

As far as this particular couple is concerned, there is no doubt that they derive a tremedous amount of enjoyment from their set. They are proficient lip readers, to the extent that they seem to be able to follow most of the program material available.

These people lived well out of my district and this made it difficult for me to service the set. I did so during the guarantee period and for a little while thereafter, but I could not continue in this role. I explained the situation to them and they accepted it. So I bowed out.

In the meantime their relative had remained a regular customer. I had kept his set in good condition and he was more than satisfied with its performance. Not so the deaf couple apparently. In recent years, every time they saw his set they expressed their disappointment at the way their set had been serviced.

Then, quite recently, their relative approached me. The couple had moved into a home unit not far away. Now that they were within a reasonable distance of my shop, would I have a look at the set and try to get it back to something like the standard of his own set? Naturally, I agreed.

An examination of the set in the home revealed lack of height, vertical non-linearity, and a slight amount of vertical jitter. Using a pencil and note pad I described what I could see and inquired whether there were any other problems, particularly of an intermittent nature, or when the set had been running for some time. The answer was no.

I then explained that the set would need a good overhaul and that it would be best if I took it back to the shop. This was late on Tuesday and I promised to have it back the following Friday morning. They were quite agreeable to this arrangement.

The height and linearity problems turned out to be intermittent, which didn't help any when I came to track them down. Nevertheless, I eventually traced it to the "height" pot, which was one of the tab type mounted on the chassis. The construction of these particular tab pots is such that there is very little clearance between the terminals, where they are secured to the body of the pot, and the chassis on which they are mounted.

"Everyone looks like this." (Radio-Electronics.)

In situations where these pots operate at substantial voltage levels above the chassis—as in this case, where it was operating at the boost supply—there is always a risk of breakdown if manufacturing tolerances have been marginally exceeded.

Which was apparently what had happened in this case. A new pot, more carefully selected and mounted, solved that problem and a general touch up of linearity and height adjustments produced a pretty good picture.

But not perfect. The vertical jitter which I had noticed at the beginning was still there. I had more or less assumed that it was part of the height/linearity problem and would vanish when I cured that problem. Obviously, it wasn't.

In cases of vertical jitter, I first try to determine whether the trouble is in the vertical oscillator or vertical output stage. Usually, if it is in the oscillator stage, the sync will be effected and the picture may tend to roll. At the very least, sync will be unduly critical.

In this case there were no such symptoms, so I assumed that the trouble was in the output stage. First off, I tried a new output valve. When this made no improvement, I tried a new oscillator valve, just in case. This also made no difference.

Next, my attention was drawn to the area around the horizontal output section of the set. It had obviously suffered a "burn-up" of some kind in the past, and the whole area was in a very grubby condition, with a layer of black soot over the chassis, the wiring, and the valve sockets. Inasmuch as part of the vertical circuit is powered from the boost voltage, which is derived from this section, I felt that there was some possibility that the trouble might be here. In any case it seemed reasonable to clear up as much of the mess as possible.

I tackled the job with a proprietary solvent and a small paint brush, and managed to make a pretty good job of it. There was only one snag; when I switched the set on again the 6AU4 damper diode socket went up in smoke. Don't ask me why. I can only assume that I disturbed some foreign matter and shifted it from a harmless position to one where it could cause trouble. Either that, or the socket was about to fail anyway.

Replacing the socket wasn't exactly a fun thing. It was a manufacturer's type, which I didn't have in stock, and it was riveted in. The result was an awkward job of rivet drilling, followed by the need to drill extra holes to take the next most suitable socket available. Naturally, that particular socket position was one of the least accessible in the set!

Anyway, I eventually completed the job, and this put the set back into operation. But it did nothing for the jitter. From previous experience I knew that there were several capacitors in the vertical section which could cause this fault, and that the type used was old enough to be under suspicion. Rather than waste time checking each one, I made a blanket job of changing about eight.

Unfortunately, this provided no immediate benefit, the only consolation being that I might have forestalled trouble in the future. Next I checked likely resistors in the vertical system negative feedback line, remembering a previous case where these have given somewhat similar

symptoms. Again I drew a blank.

What about the vertical output transformer? Yes, I had known this to give the same kind of trouble. Fortunately, I had a spare on hand and it wasn't a particularly difficult job to patch it in. But it didn't help, except to clear that component.

I also had another yoke on hand and, while I had never known a yoke to give this kind of trouble, I was beginning to clutch at straws. Since it wasn't hard to swap them over, I felt it was worth a try. As before all I did was establish what wasn't the cause.

While I was still convinced that the trouble was in the output stage, rather than the oscillator section, I decided to make another test. A trick I have used many times in the past is to disconnect the oscillator stage and feed a substitute signal into the grid of the output stage. The substitute signal is nothing more than some 50Hz voltage picked up from the heater line.

The result was somewhat inconclusive. There was no doubt that the jitter was still in evidence, but I had the feeling that it wasn't quite so obvious. Naturally, it wasn't the kind of thing about which one could be very definite.

I restored the connection to the oscillator stage but, for the moment, could think of nothing else to try. I simply sat and stared at the picture in the hope that it would provide some inspiration. To be honest, I didn't really expect it would, but the truth is it did.

I realised that the variations in picture height were being accompanied by unusual variations in picture width. With most vertical jitter faults a reduction in height is normally accompanied by a slight increase in width. In this case, the opposite was happening; as the height dropped the width decreased slightly.

It wasn't easy to be sure about this, since it mean't watching both functions at the same time, but I eventually satisfied myself that it was so. This put a completely different light on things; the fault was probably nothing to do with the vertical section, but almost certainly something to do with the power supply.

Thus re-inspired I attacked this part of the set. It employs a conventional voltage doubler arrangement and it seemed to me that the faulty component should not be hard to find.

I hooked the CRO across the supply rail and, sure enough, there was the jitter, in exact synchronism with the jitter on the picture tube. As a further check I moved the CRO prod back to the secondary of the power transformer. There was no jitter here so, presumably, it was somewhere between the transformer and the final output capacitor.

I substituted new rectifier diodes, I substituted new electrolytic capacitors, I shorted out the choke—in case it had an intermittent fault—but all to no avail.

Once more I seemed to have reached a dead end. What made things worse was that I was running out of time. Naturally, I had had other things to do, and it was now Friday morning. To keep my promise, I should deliver it in the next few hours but, right now, I felt it might take me another week!

To be on the safe side I rang the couple's relative and asked him if he could get a message to them explaining that I had been delayed. He, in turn, rang a tenant in the same block of home units who passed a written message to them.

That done, I relaxed a little. What's more, I'm convinced it enabled me to think a little more clearly. I reviewed the situation. I had definite evidence of a fluctuating HT rail, in unison with the jitter, yet I could find no fault in the power supply. The implication was that the voltage variations I was observing were symptoms rather than cause, meaning that the fault was in yet another part of the set.

But if it was, why hadn't it produced some more direct symptoms? As I asked myself the question, I had a horrible feeling that I knew the answer. I have a habit—which has created minor frustrations in the past—of working on sets which have purely video faults, without bothering to connect a speaker. In this case the temptation had been assisted by the fact that the speaker plug carries a safety link which opens the output valve cathode circuit when the speaker is unplugged.

So it just had to be a fault in the sound section. Thus alerted, I looked for the most likely cause; and my first nomination was the 6BV7 output valve. Maybe I have been unlucky over the years, but my experience with 6BV7s has not endeared them to me. Their most common fault is an internal short. This usually cooks the cathode resistor, which goes open circuit, putting a high voltage across the cathode bypass capacitor which then—literally—explodes.

I have lost count of the number of times I have had to clean up the mess from such an accident; one which usually scatters shredded aluminium foil into all the high voltage parts of the wiring.

I hooked the voltmeter prod onto the 6BV7 screen. There was no doubt about it this time, the voltage was up and down like a yo-yo, still in step with the jitter. I bashed the valve with the butt end of a screwdriver and the next thing I knew the screen feed resistor was going up in smoke. Instinctively, I reached for the 6BV7 to pull it out—and promptly burnt my fingers!

Well, that was the explanation. Only one aspect of it puzzled me at first. The internal short fairly obviously involved the screen but, with the cathode connection open, what did the screen short to?

There are several possibilities, but the most likely one seems to be that it was between screen and one or both of the unused diode plates in this valve. Even though these plates are not used, they are connected to chassis.

Needless to say, a new 6BV7 cured the problem. But, as I fitted it, the irony of the situation struck me; I was repairing a section of the set which was of no use whatever to the owners. In fact, had it not been for the effect it had on the rest of the set, this fault may have gone undetected for years.

Which brings me to the inevitable post mortem in such cases. Why did it take me so long to find the fault? Basically, it was my own fault for not bothering to fit a speaker to the set, but this was compounded by the lack of hearing suffered by the customers. An ordinary customer would have complained about crackles and bangs in the sound system long since, pinpointing the faulty section fairly and squarely, with the jitter very much a secondary fault.

But one thing is for sure; never again will I work on a set without a speaker, no matter what the fault appears to be.

Programming your EDUC-8 microcomputer

At this stage you will no doubt be keen to try your hand at writing some programs, so that you can really start making your computer jump through hoops. With this in mind, we take a break here from talking about hardware, and discuss basic programming.

by JAMIESON ROWE

Computer programming is a big subject, and in the space available here we will only be able to scrape the surface. We will deal only with basic machine language programming, as it affects a simple machine like our EDUC-8. Even so, it will be necessary to assume that you have a fairly good grasp of the basic operation of the machine given in an earlier section. If this material has become a little hazy, I would suggest that you read through it again before proceeding.

To recapitulate briefly, it is worth stressing again that a digital computer like EDUC-8 deals only with binary numbers. This applies to both the data upon which it operates, and the instructions which specify its operations. In fact the only difference between data and instruction numbers is that the latter are interpreted as such, a point which should become clearer as we go on.

In the case of EDUC-8, the binary numbers used for both data and instructions are of eight bits. Any eight bit number is capable of being interpreted by the machine as an instruction, in the sense that all combinations of eight bits have a significance when interpreted as an instruction.

For example the binary number 00000000 corresponds to zero when it is interpreted as a data number, but if interpreted by EDUC-8 as an instruction it causes the machine to perform a logical AND operation between the number in the accumulator register (AC) and the number stored in the memory location whose address in 0000 in the current memory page—that 16-word portion of the memory in which the instruction itself is stored.

In the same way, the number 11111111 is equivalent to decimal 256 in simple binary, or minus 1 in two's complement binary. But if interpreted by EDUC-8 as an instruction, it would cause the machine to increment the program counter if the number in the AC register is either zero or negative, at the same time rotate the number in the AC register one bit to the right, and finally halt the program.

As noted earlier, there are eight basic types of instruction "trick" in the machine's repertoire, with some of these having a variable form determined by the location in memory of the operand to which they refer, and others being subdivided into specific sub-tricks or micro-instructions. Every different micro-instruction and instruction form has its own specific 8-bit binary code number.

In the truest and most basic sense, then, a computer program is a sequence of binary numbers, in this case each of 8 bits. The computer itself is quite incapable of interpreting instructions in any other form. A program written in binary number form is thus said to be in machine language".

Unfortunately, we human beings who must write the programs do not find it particularly easy to remember all of the binary code numbers corresponding to the various instructions. For convenience, then, it is usual for programmers to visualise and write machine language programs in octal notation. This gives code numbers which are quite readily remembered and manipulated, after a little practice.

For example an instruction whose binary form is say 01101101 becomes 315 in octal form, while another whose binary form might be 11110010 becomes 722. You can see from these how much easier machine language programming becomes by using octal notation.

It is important to realise, however, that if programs are written in octal notation, or in any other non-binary form, this is done purely for the convenience of the human programmer. Computers themselves "understand" only binary numbers, and regardless of their initial form, all programs must ultimately be fed into the machine in binary.

A program written in octal notation is somewhat easier to handle than in binary, but still tends to be rather abstract and inconvenient from the human viewpoint. There is no obvious functional correspondence between the code numbers and the instructions they represent, making it necessary for them to be learned by rote. Even when this is done, it is by no means easy to visualise the operation of a program simply by scanning the code numbers.

It is for this reason that programs are often written in what is called "mnemonic language". Here each type of instruction is represented by a three or four letter symbol, whose form is arranged to make its significance easily remembered. Hence the symbol "AND" is used to represent the logical AND instruction, for example, while "JMP" is used to represent the jump instruction.

Other easily remembered symbols are used to represent variations in the form of instructions, and as labels for memory addresses. For example an instruction might be written as "TAD I POINTR", where TAD stands for two's complement addition, I indicates that the instruction involves indirect addressing, and POINTR is the label given to the address in the current memory page containing the address of the operand.

So that you can start to become familiar with the octal coding and mnemonic symbols for the instructions in EDUC-8's repertoire, I have drawn them up as a table. This can be used as a convenient guide when writing programs, until you get to the stage where you know them all by heart.

By writing a program initially in mnemonic language, it is relatively easy for the programmer to visualise its operation. Of course it is still necessary to translate the program into binary coding for the machine, but this is not difficult if handled in octal. After a while, you'll be able to set the SR switches of the machine in binary, from octal coding, without batting an eyelid!

Needless to say, the translation from mnemonics into code is rather tedious, and the ideal solution is to have the computer do the job itself. In fact this is always done with full-scale machines, where a program known as an "assembler" is supplied as part of the software package sold with the machine, for this very purpose.

The idea is that the assembler program is stored in the machine, and under its control the machine reads the symbolic version of the new program—say from punched paper tape—and translates it to produce the binary code equivalent. This may be punched out as a second paper tape, known as the "object" tape. It is the object tape which is then used to feed the new program into the machine, when it itself is to be run.

Programs written in mnemonic form are often said to be written in "assembly language", to emphasise that they are one stage removed

Recommended for further reading

Of necessity, the discussion of basic computer programming given here is only a brief introduction to the subject. It covers the basic principles, to a degree which should enable you to begin writing simple programs with a fair amount of confidence and success. But there will inevitably be questions raised in your mind which will remain unanswered.

For a more complete introduction to the subject, I can only suggest that you refer to a modern textbook on the subject.

A book I can warmly recommend is "Introduction to Programming", published by the Digital Equipment Corporation. It is available from Digital Equipment Australia Pty Ltd, at a cost of $2.50 including post and packing.

To obtain a copy, send a cheque for the above amount to the Education Manager, Digital Equipment Australia Pty Ltd, 123 Willoughby Road, Crows Nest 2065, with the envelope marked "Electronics Australia Enquiry".

from true machine language. But it should be noted that there is a simple 1 : 1 relationship between the two, in the sense that for every machine language instruction to be performed ultimately by the machine, there must be a corresponding assembly language instruction.

As you are probably aware, this process of using the computer itself to simplify programming and reduce the tedium is often carried a stage further. By providing the machine with a more elaborate translation program known as a "compiler", it can be made to translate programs written in more abstract language. The compiler program can be arranged to generate whole sequence of machine language instructions in response to a single input command, freeing the programmer from the need to worry about every tedious detail.

You have no doubt come across the names of the more abstract or "higher level" programming languages which have been developed to take advantage of compiler translation: FORTRAN, ALGOL, COBOL, BASIC, FOCAL, and so on. Because these programming languages make it particularly easy to write problem-solving programs, and have them running rapidly (after compiling), they are often called problem-orientated programming languages.

As you might expect, a compiler program tends to be quite long; very much longer than could be fitted into the 256-word memory of EDUC-8. This means that the convenience of writing programs in a problem-orientated language is simply not available with this machine, unless you care to compile programs manually.

On the other hand it may well be possible to write an assembler program small enough to fit into the machine's memory, to permit automatic assembly of programs written in mnemonics. I have not had time to try writing such a program as yet, but hope to do so soon. Details will certainly be published, if this proves practical.

In the meantime, I suggest that you write your programs in mnemonic form, and then manually code them in octal using the guide table. This is not difficult, and will be good practice. With the programs in octal form, for the time being you can feed them into the machine manually via the console switches. Later on, when you perhaps have a paper tape punch and reader, you can turn them into binary tapes for rapid and convenient loading.

Before we turn our attention to the actual "nitty gritty" of programming, a few broad comments on techniques are probably in order.

The first step in programming is to make sure that you define clearly the task which the computer is to perform. This may sound trite, but it is not. It is very important, for unless the task is clearly defined, it is all too easy to produce a program which may perform a task other than the one you really wanted. As it may be hard or tedious to modify it later on, the best way to avoid a lot of wasted effort is to make sure of defining the goal in the first place.

Having defined the job to be done, the next step is to decide upon the way in which it can be achieved. This step often tends to blend with the third step, which is that of analysing the task and breaking it down into the specific computer operations which will be necessary.

A very useful technique which can be used to simplify these steps is flowcharting. This involves drawing a graph or flowchart, which shows the various steps which will make up the program, and the logical sequence in which they are performed. By letting you visualise more clearly the steps involved, the flowchart makes it easier to refine and simplify the program before you progress any further. It also makes it possible to compare various approaches in tackling the problem (there are usually a number of possible ways, and it may not be easy to pick the most efficient).

After using flowcharts to settle upon the approach and refine the exact way in which the steps are to be performed, the next phase is to actually write the program. This is generally known as the "coding" phase.

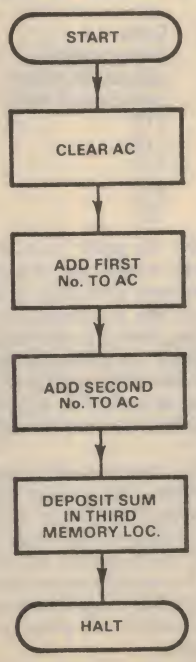

FIG. 1

You might imagine that this would be the last real stage in the process of programming, followed only by assembly and storage in the machine before operation. However this is rarely the case. Generally there is a further stage, because human fallibility almost always ensures that a program won't work in its initial form.

The final stage is therefore one in which you perform "debugging". This involves running the program one or more times, noting the errors it makes, analysing these with the flowcharts and the written version of the program, and making the appropriate modifications to remedy matters. The modified assembly language version is then assembled once more, to produce the final object tape (hopefully!).

Let us now turn to the detail of programming. Probably the best way to start is with a very elementary example.

Suppose we have two numbers, stored in memory locations, and we wish to add one to the other and store their sum in a third memory location. This is a very simple task, and would not normally involve a program of its own; it would simply form a minor step in a larger program. However for the sake of the exercise, a flow-chart for the steps involved is shown in Fig. 1.

This is a very simple flow-chart, as you can see. There are only two different sorts of operation symbol, and the logical flow is in a simple linear fashion between the rounded START and HALT terminations. The rectangular boxes represent the functional steps, with the arrows

EDUC-8 PROGRAM ENCODING GUIDE

Mnemonic	Operation	Code
	MEMORY REFERENCE INSTRUCTIONS	
AND	logical AND	0XX
TAD	2's complement add	1XX
ISZ	increment and skip if zero	2XX
DCA	deposit and clear AC	3XX
JMS	jump to subroutine	4XX
JMP	jump	5XX
	(XX = operand address and mode)	
	OPERATE (OPR) MICROINSTRUCTIONS	
NOP	no operation	700
IAC	increment AC	701
RAL	rotate AC one bit left	702
CMA	complement AC	704
CLA	clear AC	710
NOP	no operation	720
HLT	halt at end of execute cycle	721
RAR	rotate AC one bit right	722
SMA	skip on minus AC	724
SZA	skip on zero AC	730
	COMBINED OPR MICROINSTRUCTIONS	
CLA.IAC	set AC to contain 1	711
CLA.CMA	set AC to contain –1	714
SZA.SMA	skip if AC is zero or minus	734
CMA.IAC	complement and increment AC (form 2's complement)	705
	INPUT/OUTPUT TRANSFER (IOT) INSTRUCTIONS	
SKF	skip on input flag	601,611
SDF	skip on output flag	621,631
KRS	read input buffer	602,612
LDS	load output buffer	622,632
RKF	reset input flag	604,614
RDF	reset output flag	624,634
	COMBINED IOT INSTRUCTIONS	
KRB	read input buffer, reset flag	606,616
LDB	load output buffer, reset flag	626,636

on the connecting lines showing the direction of flow.

The reasoning behind the various steps should be fairly self-evident. The accumulator register is first cleared, to make sure that there is no residue from a previous operation to confuse the issue. Then the first number is added into the accumulator, followed by the second number. This forms their sum in the accumulator, which is deposited in the desired memory location. Finally the machine is halted.

The mnemonic or assembly language form of a simple program to perform this task might look like this:

```
CLA     /start; clears AC
TAD A   /adds first number
TAD B   /adds second number
DCA C   /deposits sum
HLT     /halts
A,      /location of first number
B,      /location of second number
C,      /location in which sum is stored.
```

The first thing to note is that the actual program itself consists only of the left-hand column. All of the words to the right of the oblique slashes are comments, purely for the benefit of anyone trying to follow what is going on—including perhaps the programmer himself, at some later stage. Whether you add such comments to your own programs is entirely optional; a few at strategic points in a program can be very helpful, but it would normally be both unnecessary and tedious to put as many as shown here. I have added them merely to help you in getting the idea.

When a program written in assembly language is translated into binary code, these comments are completely ignored. Assembler programs may be arranged to do this automatically, by ignoring all characters on the symbolic tape which follow a slash and precede a carriage return.

The other main thing to note about our first program example is that the three memory locations used to store the two numbers and the sum have been given labels—"A", "B" and "C". These are simple one-letter labels, but in practice these can generally be any convenient combination of letters and numerals—as long as they do not coincide with the mnemonics used for the actual instructions. This is not so important when you are coding programs yourself, manually, but it is essential if they are going to be coded by an assembler. Any ambiguity between labels and instruction mnemonics would then lead to errors.

The main advantage of using labels is that it frees you from worrying about the exact locations of each instruction and data number in memory, at least during the initial stages. It is still necessary to keep track of your position in memory, so as to be able to satisfy the requirements for memory reference instructions. But by using the labels you can leave the exact details of memory location until last, when the actual coding is done. And if the coding is done by an assembler program you may never need to worry about the details, as the program may do it for you!

Normally if the two numbers to be added together were to be loaded into the machine as part of the program, their numerical values would be shown after the commas following their address labels. On the other hand if they were going to be loaded separately, the initial content of the two locations might be shown as zero. Similarly the content of the sum storage location would normally be shown as zero, to emphasise that the initial content is not significant. (But the latter is not necessary for correct operation of the program, as storing the sum in this location would automatically erase any previous content.)

Some of these points may become clearer if we look at the octal code equivalent to our program example. If the program were going to be stored in the computer's memory starting at the very first location, i.e., address 000, its coding would be as follows, where the locations in memory have been shown at the left for reference:

Location	Code
000	710
001	105
002	106
003	307
004	721
005	(first number)
006	(second number)
007	(sum stored here)

I suggest you spend a little time comparing this with the assembly language form, as this is probably the best way of grasping some of the ideas of coding. Note that the program occupies eight memory locations, five for the actual instructions and three for the storage locations. The two numbers to be added together would be stored along with the instruction numbers, in locations 005 and 006, and after the program has been run their sum will be found in location 007.

If you look carefully at the coding for the three memory reference instructions, some of the points made earlier about the details of memory location should start to become clearer. Because they must refer to the location of the operand concerned, the exact coding for such instructions varies with the position of the operand in memory. This is in contrast with the operate microinstructions, whose coding remains fixed.

To emphasise this, here is how the coding for the same program would look if we were to store it in the next group of eight memory locations, at the same time changing the positions of the three data storage locations so that they precede the instructions instead of follow them:

Location	Code
010	(first number)
011	(second number)
012	(sum stored here)
013	710
014	110
015	111
016	312
017	721

Notice how the exact form of the memory reference instructions has changed, to correspond to the new addresses of the operands, while the operate microinstructions are unaltered. The fact that the data storage locations are now "ahead" of the actual instructions has only altered the exact coding of the program, however, not its operation. It is still an entirely valid coding for the program task we wished to perform.

In practice it is often convenient to place at least some of the data storage locations before the actual instructions. The only thing to watch when this is done is that you remember to always start the program at the first actual instruction. If this is not done, the machine will fetch data numbers and interpret them as instructions — which can produce some rather strange results!

I hope this very elementary programming example has helped you to grasp some of the rather subtle concepts involved. If nothing else, you will hopefully have begun to see by now the way in which instructions and data numbers stored in the machine differ only in terms of interpretation.

Let us now consider a programming example that is a little more complex. Say we have two numbers stored in the machine's memory, as before, but this time we wish to find the difference between the two and store it again—but always as a positive number. This time the flowchart would be as shown in Fig. 2.

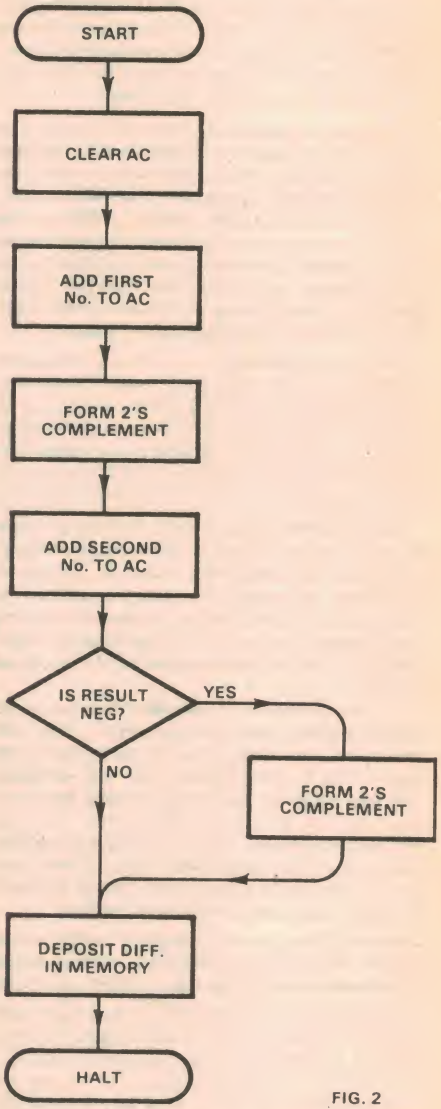

FIG. 2

Here we cause the two numbers to be subtracted, instead of added, by turning the first into its negative equivalent (in 2's complement binary notation) before the second is added. This leaves their difference in the AC; but as we have no way of knowing which of the two numbers will be the larger, this difference may be either positive or negative.

As we wish to store the difference in positive form, it is therefore necessary to make the program perform a logical decision (diamond shaped box), and branch in one of two directions depending upon the result of that decision. If it finds the result is positive, it should store it away unchanged; but if the result is negative, it should convert it into the equivalent positive number before storing it.

This is done by forming the two's complement of the difference, in the same way used to negate the first number.

A program written in assembly language to perform this task might look rather like this:

```
START,  CLA          /clears AC
        TAD NUMA     /adds first number
        CMA. IAC     /forms 2's
                      complement
        TAD NUMB     /produces difference
        SMA          /is diff negative?
        JMP STORE    /no, go to store it
        CMA.IAC      /yes, form 2's
                      complement
STORE,  DCA DIFF     /store it
        HLT          /halt
NUMA,                /first number
NUMB,                /second number
DIFF,                /difference stored
                      here
```

Here the labels "NUMA", "NUMB" and "DIFF" have been used for the three data storage locations, just to show you another possibility. Similarly a label "START" has been attached to the first instruction, mainly to clarify exactly where the program starts. This can be very worthwhile if there are data storage locations ahead of the instructions. The second last instruction has also been labelled "STORE", but for a more important reason which should emerge in a moment.

The conversion of the first number into its 2's complement is performed by a single instruction, the combined operate microinstruction CMA.IAC. The second number is then added to the AC as before, in this case forming the difference.

The logical decision and program branching is achieved by using the operate microinstruction SMA, together with a JMP instruction. If the difference stored in the AC is negative, the effect of the SMA microinstruction is to cause the program to skip the next consecutive instruction, so that it automatically goes to the seventh instruction (CMA.IAC) and forms the 2's complement of the difference as required, before storing it. But on the other hand, if the difference is already positive, the SMA microinstruction will not cause a skip, and the program will instead go to the next consecutive instruction.

This instruction is the JMP instruction, and its purpose is to allow the program to proceed directly to store the difference. This is achieved by giving the "DCA DIFF" store instruction the label "STORE", and writing the jump instruction as JMP STORE. If the program is coded by an assembler program, this will cause the correct coding to be automatically generated, taking into account the actual memory location of the instruction which is effectively the operand of the jump instruction.

If it were to be stored in the computer's memory starting at location 000, the octal coding for this second program example would be:

Location	Code
000	710
001	111
002	705
003	112
004	724
005	507
006	705
007	313
010	721
011	(first number)
012	(second number)
013	(difference stored here)

This is a very simple example of a program involving a logical decision and so-called "conditional branching", but even so it illustrates that a program is not necessarily confined to the simple execution of a linear sequence of instructions. The ability of the machine to test for certain conditions, and branch in various directions according to the result of the test, expands the whole scope and flexibility of programming considerably.

Of the operate microinstructions in EDUC-8's repertoire, there are three which are used in this way for conditional branching: SMA, SZA and their combination SZA.SMA. Instructions which may also be used for conditional branching are the IOT skip instructions SKF and SDF, and the memory reference instruction ISZ.

The ISZ instruction is in fact very powerful. One of its other applications is for another important programming technique known as "looping". The best way to illustrate this is with another simple example.

Let us say you want to repeat a certain sequence of instructions five times. One way to do this would be to simply repeat the group of instructions five times, so that the machine performed them one after the other. However this would tend to take up a considerable amount of memory. This space can be almost completely saved by arranging for the program to loop around and perform the single group of instructions five times, before continuing.

The principle used to achieve looping is shown in Fig. 3. Ahead of the sequence of instructions to be performed a number of times, a storage location is loaded with a number known as the "index", whose value is made equal to the 2's complement of the number of times the instruction sequence is to be performed. In this case the index is set to minus 5, as we wish to perform the sequence five times. This preliminary operation is known as "initialising".

After the actual sequence of instructions to be repeated, the index number is arranged to be incremented. Then the program is arranged to test whether the value of the index has become zero or not. If not, the machine is made

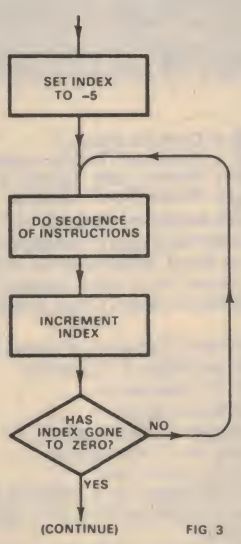

FIG. 3

to jump back to the start of the sequence. If on the other hand the index has become zero, the machine is allowed to continue with the next consecutive instruction.

Because the index has initially been set to the 2's complement of the number of times the sequence should be repeated, it will not actually reach zero until the correct number of loops has occurred. Thus with our example where the index is set to minus 5, the program will automatically loop five times before proceeding.

The ISZ instruction can be used to perform both the index incrementing, and the testing to see if its value has reached zero. The looping back is then arranged simply by following the ISZ instruction with a JMP back to the start of the loop, as follows:

```
        . . . .
        . . . .
        CLA
        TAD CONST
        DCA INDX     /initialises index to
                      −5
GO,     . . . .      /sequence
        . . . .      /of
        . . . .      /instructions
        ISZ INDX     /increment index,
                      test
        JMP GO       /not zero yet, keep
                      going
        . . . .
        . . . .
```

Note that CONST would be a storage location with the number minus 5 as its content, while INDX would be another location used to store the index. The rows of dots represent the instructions before, inside and after the loop. Note that the loop may include any desired number of instructions.

Looping is a particularly useful technique, as you can imagine. It allows considerable reduction in the length of programs, as most programs involve a certain amount of repetition. Or looking at it in another way, looping allows more efficient use of computer memory, so that more elaborate programs can be fitted into the available space.

Note that the ISZ instruction is not the only one which can be used as the basis of looping. Broadly speaking, any of the skip instructions can be used to achieve looping, just as they can be used to achieve branching. The most appropriate instruction to use for looping depends upon the type of loop required—whether the program should loop for a fixed number of times (unconditionally), as in our example, or until some condition has been reached. The ISZ instruction is often the most suitable for the former, but instructions like SMA, SZA, SKF and SDF are generally more suitable for the latter.

An interesting example of the use of looping is where two numbers are to be multiplied together. Here one number may be used to control the number of times the other is added to itself, by converting the first number into its 2's complement and using it as the index for a loop around an instruction added the second number to the AC:

```
MULT,   TAD NUM1
        CMA.IAC
        DCA INDX     /initialises
ADD,    TAD NUM2
        ISZ INDX     /finished yet?
        JMP ADD      /no, keep going
        HLT          /yes, halt
NUM1,                /first number
NUM2,                /second number
INDX,   000          /index stored here
```

Note that in this case the program would halt with the product of the two numbers in the AC register. It could be arranged to store the result in a suitable location, like the earlier examples, simply by adding the appropriate DCA instruction between "JMP ADD" and "HLT".

A flow chart for the example just given is shown in Fig. 4, to allow you to follow through the idea a little more easily.

Apart from its use in arranging program looping, the ISZ instruction can also be used to actually modify the instructions within the loop, so that the program need not simply repeat a sequence exactly the required number

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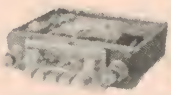

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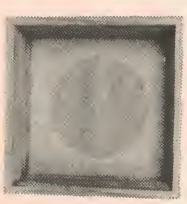

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of times, but can perform a series of similar operations. An example of this is well worth looking at, because it demonstrates that instructions are not necessarily "sacred" and unalterable.

Say you have a set of eight numbers stored in consecutive memory locations, and you wish to add them all together to form their sum in the AC register. One way of doing this would be to have a sequence of eight different TAD instructions, each one referring to one of the eight locations. But it is more efficient to use looping around a single TAD instruction, and simply modify the address part of the instruction each time.

Thus if the locations in which the numbers are stored are given the labels "A", "A+1", "A+2", etc, the program would look like this:

```
START,  CLA
        TAD CONST
        DCA INDX      /initialises index
GO,     TAD A
        ISZ GO        /modify instruction
        ISZ INDX      /done 8 times?
        JMP GO        /no, keep going
        HLT           /yes, halt
CONST,  370           /minus 8
INDX,   000
A,                    /first number
A+1,
A+2,
. . .
. . .
```

Only the first three data number locations have been shown, with dots to suggest the remaining locations. Note that the value given for CONST is the 2's complement of decimal 8, in "377" format octal notation.

Of the two ISZ instructions used in this example, only the second is used "fully"—i.e., to both increment and test whether the operand has reached zero. The first ISZ instruction is used purely to increment the TAD instruction, and this is a perfectly valid way of using an ISZ instruction.

The only thing the programmer must do when using the ISZ instruction in this way is make sure that the number or instruction being incremented will never reach zero, or alternatively ensure that the program does not make an error if it does. In this example we know that the TAD instruction will only be incremented 8 times, so that there is no problem.

In cases where it is not easy to predict if zero will or will not be reached, and no branching or looping must occur, the best idea is to follow the ISZ instruction with a NOP or "no operation" instruction.

Although the method just illustrated can often be used to perform a series of similar operations, it is not always convenient to directly modify an instruction or sequence of instructions. For one thing, this complicates matters if the program is to be re-run, because the modified instruction or sequence of instructions will have to be changed back to their initial coding.

In such cases, use can be made of a similar technique, but one which uses indirect addressing via a "pointer". Here the pointer is incremented to change the memory locations referenced, not the basic instructions.

For an example of this, consider a situation where we have a set of eight numbers in consecutive memory locations, as before, but this time we want to add a constant—say octal 60—to each one, and replace it in its initial location. A program to do this could take the following form:

```
START,  CLA
        TAD CONST
        DCA INDX      /initialises index
        TAD BUFSA     /fetches add. of
                       first no.
        DCA POINTER   /initialises pointer
GO,     TAD I POINTER /fetch number
        TAD CON60     /adds 60
        DCA I POINTER /replace number
        ISZ POINTER   /increment pointer
        ISZ INDX      /finished yet?
        JMP GO        /no, continue
        HLT           /yes, halt
CONST,  370
INDX,   000
BUFSA,                /address of first no.
POINTER,000           /pointer stored
                       here
CON60,  060
A,                    /first number
A+1,
A+2,
. . .
. . .
```

It is possible to use the one number as both index and pointer, in some situations, and this can be used to simplify and shorten the program still further. In the example just given, this could be done fairly easily, by arranging for the eight data numbers to be stored in the last eight locations in memory. The value of INDX each time would then automaticaly correspond to the required pointer address. You may care to try re-writing the program to do this, just for the exercise.

Along with the technique of using a pointer, the example just given also shows one important application of indirect memory addressing. Another important application of this should become apparent in a moment, as we discuss another very useful programming technique—the subroutine.

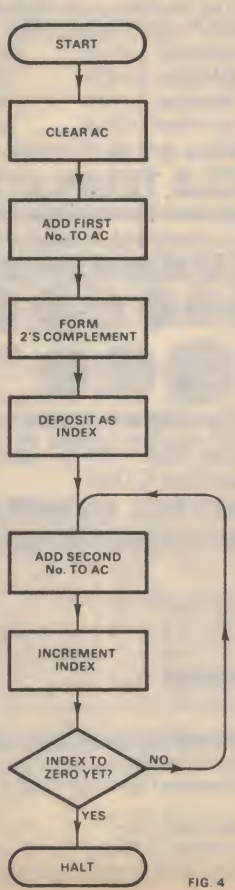

FIG. 4

Like looping, subroutines are used to allow a particular sequence of instructions to be used repeatedly during a program. But the advantage of the subroutine is that the sequence may be used in many different parts of a program, not necessarily in contiguous fashion. The sequence is made a separate entity, with the program jumping to it as required—and then returning back to where it jumped from, each time.

The general idea is shown in Fig. 5. As you can see, the subroutine is in effect a separate program module, to which the machine jumps from the main program whenever the subroutine sequence is needed. After having used the subroutine, the machine then jumps back to the main program, to continue on from where it was.

The instruction which is used to provide subroutines is the JMS instruction. This is a little like the JMP instruction, in that it has the effect of replacing the existing content of the PC register so that the machine takes its next instruction from a place other than the next consecutive location. But in contrast with the JMP instruction, where the existing content of the PC register is lost, with the JMS instruction the PC content is stored in the address given in the instruction, and the next instruction taken not from that address, but from the one after that.

This is used in the following basic way. The first location of a subroutine sequence is set aside as a storage location, immediately before the first of the actual subroutine instructions. Then whenever the subroutine is needed in the main program, a JMS instruction is used, specifying the address of the storage location. The effect of the JMS instruction is to store in that location the address of what would otherwise have been the next consecutive instruction in the main program, and to take the first subroutine instruction as its next actual instruction.

In other words, the JMS instruction causes the machine to jump to the subroutine, but at the same time stores the address in the main program to which it should return, in the subroutine storage location. This stored address is known as the "return address", for fairly obvious reasons.

To arrange for the machine to jump back into the main program at the end of the subroutine, it is merely necessary to make the last subroutine instruction an indirect JMP instruction, specifying the storage location at the start of the subroutine. The machine then automatically fetches the return address from the storage location, and places it into the PC register.

In terms of actual instructions, a subroutine and its associated JMS instructions tend to look as follows, when encountered in an assembly language program:

```
        . . .
        . . .
        . . .
        JMS SUBRT
        . . .
        . . .
        JMS SUBRT
        . . .
        . . .
        JMS SUBRT
        . . .
        . . .
SUBRT,  000     /stores return add. here
        . . .   /first subr. instructions
        . . .
        . . .
        . . .
        JMP I SUBRT   /fetches return
                       add . to exit
```

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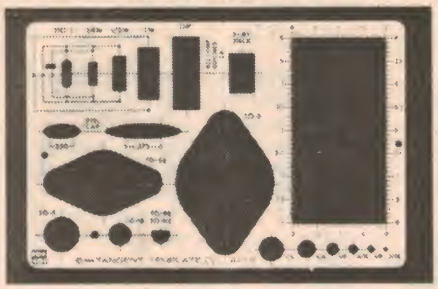

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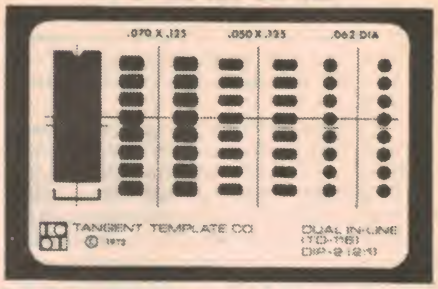

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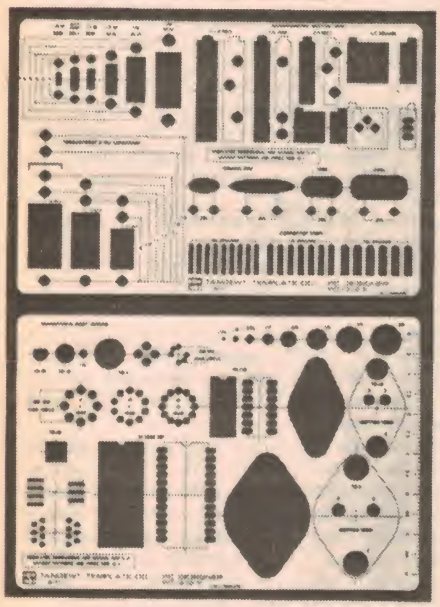

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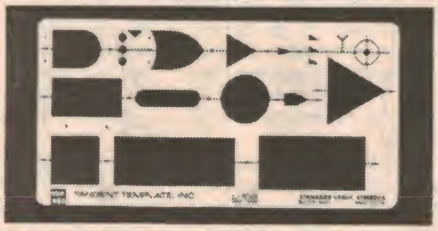

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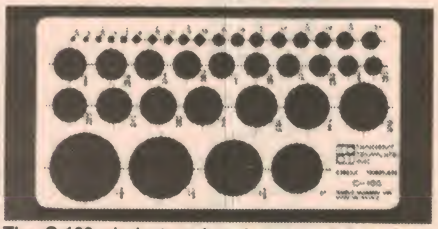

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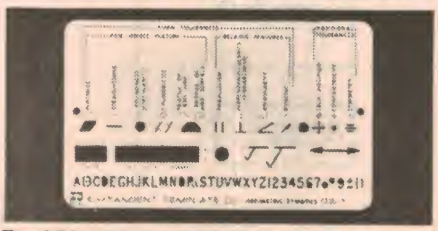

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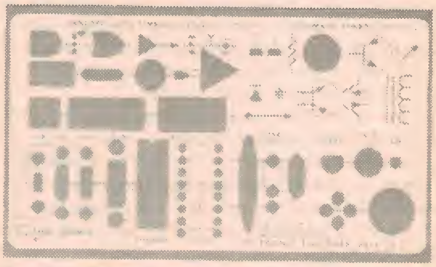

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main program, with JMS instructions wherever the subroutine is needed. The subroutine itself is beneath it, with its storage location for the return address at the start, and the indirect JMP instruction used to exit at the end. Note that although the label "SUBRT" has been used here for simplicity, any other suitable label may be used.

This is the basic way of providing a subroutine, and is probably the way most often used. It is possible to elaborate on the basic idea, for example if you want to transfer additional data numbers into and out of the subroutine (normally the only data transferred is the content of the AC register), but space limitations prevent us from going into this further here.

An important application of subroutines is in servicing input/output devices, and we will look at this shortly. However before we do, it may be worthwhile to mention briefly the general use of indirect addressing for memory reference instructions, in connection with memory pagination.

As mentioned in the earlier section dealing with basic machine operation, the eight-bit instruction words used in EDUC-8 do not allow direct addressing of all memory locations. This is because a full eight bits would be needed to address 256 locations, and at least three of the eight instruction bits are already required, for the operation code.

In fact, there are only four bits available for the actual operand address portion of a memory reference instruction, as bit 4 is used to indicate the addressing mode. As there are only 16 combinations possible with four bits, this means that any given memory reference instruction can only specify one of 16 partial addresses.

This problem is not unique to EDUC-8, but is in fact shared with many minicomputers. The only difference is one of scale—with a typical commercial machine, some 256 partial addresses may be specified, rather than just 16. And with EDUC-8, we get around the problem in the same way used in a commercial machine.

The convention adopted in the machine is to divide the memory effectively into "pages", in this case of 16 locations each. The full 256-word memory of the machine is thus considered to consist of 16 pages, each comprising 16 locations, and with octal addresses as shown:

000—017	200—217
020—037	220—237
040—057	240—257
060—077	260—277
100—117	300—317
120—137	320—337
140—157	340—357
160—177	360—377

In effect, the instruction decoding logic of the machine "assumes" that the partial address given in a memory reference instruction refers to the corresponding actual address lying in the same page as the instruction itself. Thus if a TAD instruction is in the first page of memory and has the octal code 105, the machine will regard the location specified as that with the address 005. However a TAD instruction with the same coding, but in the last page of memory, will be taken as specifying the location with the octal address 365.

This applies to both direct and indirect addressing, in the sense that the address of the actual operand address specified in an instruction is also assumed to lie in the same page as the instruction. So that if an indirect DCA instruction with octal code 313 is located in the first page of memory, in executing the instruction the machine will seek the number stored in memory at address 013 as the address at which to store the AC register contents. But if the same instruction code were encountered on the second last page of memory, the machine would seek the storage address at memory address 353.

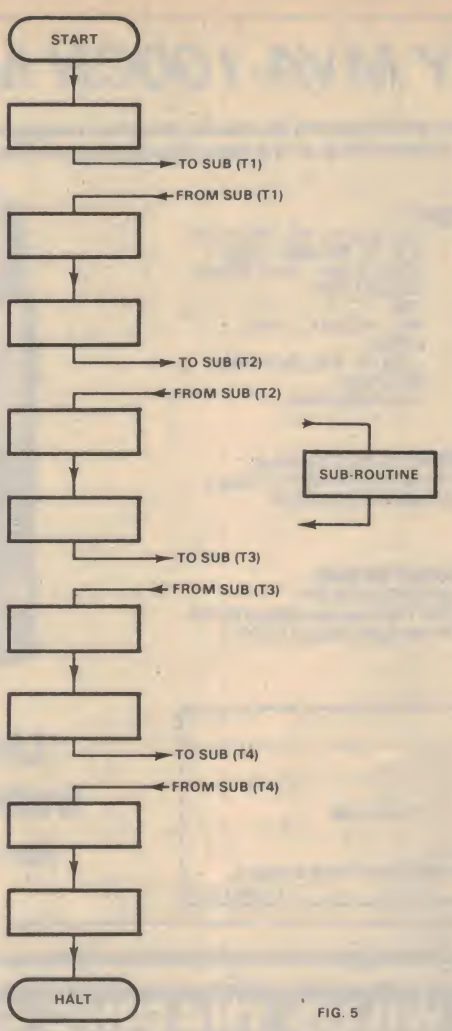

FIG. 5

From the programmer's point of view, the effect of all this is to restrict the range of locations which may be specified by a direct addressing memory reference instruction, to those locations within the same memory page as an instruction itself—known as the "current page". However if you want to specify a location outside the current page, all that is necessary is to use indirect addressing instead, with a location on the current page used to store the actual operand address.

An example should illustrate the idea. Say you are in the first page of memory, and need to deposit the AC contents into the location with octal address 246, in the eleventh page. The way to do so is to assign a suitable storage location on the current page, say at address 017, and store in that location the desired depositing address—octal 246. Then in the program itself all that is required is the indirect addressing DCA instruction with octal code 337.

If you find that "337" a little hard to work out, it is made up as follows. The first figure is the operation code for a DCA instruction, octal 3, which is no problem. The remaining two figures are actually a combination of 017, the address of the current page storage location, and 020, which is the octal representation of the bit (bit 4) which indicates an indirect addressing memory reference instruction.

To round off this introductory look at programming, let us now consider briefly what is involved in programmed transfer of data to and from peripheral devices. This is usually called "IOT servicing"

As mentioned in an earlier section, IOT servicing involves three distinct operations. One is testing the flag line of the IOT device concerned, to see if the device is ready to "do business"; this is often described as testing flag status. The second operation is transferring the actual data, and the third is resetting the device flag. The latter not only prepares for the next servicing cycle, but generally also serves to indicate to the device that the data transfer is complete, at least from the computer's viewpoint.

The three instructions which perform these operations for an input device are nominally labelled SKF, KRS and RKF—although these mnemonics are arbitrary and could be varied to suit different types of input device. The second and third instructions may be combined to produce the instruction nominally called KRB, which transfers data and resets the device flag in the same execute cycle.

These instructions are used to service an input device such as the simple keyboard unit by arranging them in the following sequence:

```
TEST,   SKF        /is flag set?
        JMP TEST   /no, keep looking
        KRB        /yes, transfer and reset
```

As you can see, the SKF instruction is arranged to form part of a small program loop, by following it with a JMP instruction which forces the program to jump back to SKF again. While the device flag remains reset, the program thus "twiddles its thumbs" by jumping back and forth between the two instructions.

However as soon as the device flag is set, indicating that the keyboard has a character ready for transfer, the program can escape from the loop because the SKF instruction will cause the JMP instruction to be skipped. The machine will then fetch and execute the KRB instruction, transferring the character into the AC register and resetting the keyboard flag. Fig. 6 illustrates the technique in flow-chart form.

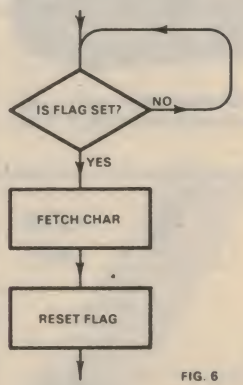

FIG. 6

A similar instruction sequence is used for servicing output devices, where the corresponding instructions are SDF, LDS and RDF, or LDB combining the second and third. However many output devices like paper tape punches and printers have drive mechanisms, which may be deactivated when the flag FF is set. For this reason, the instruction sequence

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7402	50c	7474	1.10
7404	54c	7475	1.10
7408	56c	7476	1.20
7410	50c	7490	1.25
7413	85c	7492	1.52
7420	50c	7493	1.50
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7442	2.00	74141	2.98
		74192	3.50

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555	Timer	1.95
556	Dual 555 Timer	2.96
LM565	Phase locked loop	4.65
LM566	Voltage controlled oscillator	3.70
LM567	Tone decoder (0.01Hz to 500kHz)	5.25
709C	Operational Amplifier	1.15
710C	Differantial Voltage Comparator	1.25

The program coding blank at right may help you in writing programs. Rather than use the blank itself, however, run off photocopies and use these.

for output device servicing are often rearranged thus:

```
        LDB         /load device buffer,
                     reset flag
TEST,   SDF         /device used char yet?
        JMP TEST    /no, keep looking
```

By doing this the character is loaded into the device buffer first, and the flag reset to activate the punching or printing mechanism. Then the program is forced to wait until the device indicates that the character has been processed, before proceeding. As before this is achieved by using a JMP instruction to produce a small loop.

IOT device servicing sequences such as these are often needed many times in a program, and when this occurs it is usual to make them subroutines. Thus a program to make the machine act like an elementary desk calculator, using the simple input keyboard and octal display devices, might have two IOT servicing subroutines labelled "READ" and "DISPLY". Then whenever characters were to be read from the keyboard, this would be simply achieved by the instruction JMS READ, while to display a character would be achieved by the instruction JMS DISPLY.

The two subroutines themselves would be written as follows:

```
READ,   000
TEST,   SKF
        JMP TEST
        KRB
        JMP I READ

DISPLY, 000
        LDB
BACK,   SDF
        JMP BACK
        JMP I DISPLY
```

With EDUC-8, these are the only basic methods available for IOT device servicing. More complex machines generally offer the ability to service IOT devices in alternative ways, some of which may avoid the time-wasting flag test loop. A common approach is one employing an "interrupt" system, where the machine continues with its main program until a device signals its availability.

And with those brief details of IOT programming I must bring this section to a close. It has only been possible to deal with basic programming in a very limited way, and you will no doubt have many questions as yet unanswered. But hopefully you will now have enough basic insight into the concepts involved to provide a foundation for further study, as well as for trying your hand at some programs.

To help you in this regard, I have prepared artwork for a simple program coding sheet. This has space for 32 instructions, or two pages of memory, and provides for both writing the instructions in assembly language, and inserting the octal coding. As such, it can make program writing a little easier and more convenient. I suggest that you run the page through a copier, and provide yourself with a stack of copies to actually write programs on. This way you can keep the printed reproduction as a reference.

It has not been possible to give any examples of complete practical programs here, because of space limitations. However I will try to give some examples along these lines as we deal with further input and output devices.

EA EDUC-8 PROGRAM

STEP	MNEMONIC	CODE
0		
1		
2		
3		
4		
5		
6		
7		
10		
11		
12		
13		
14		
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17		
20		
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37		

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Circuit & Design Ideas

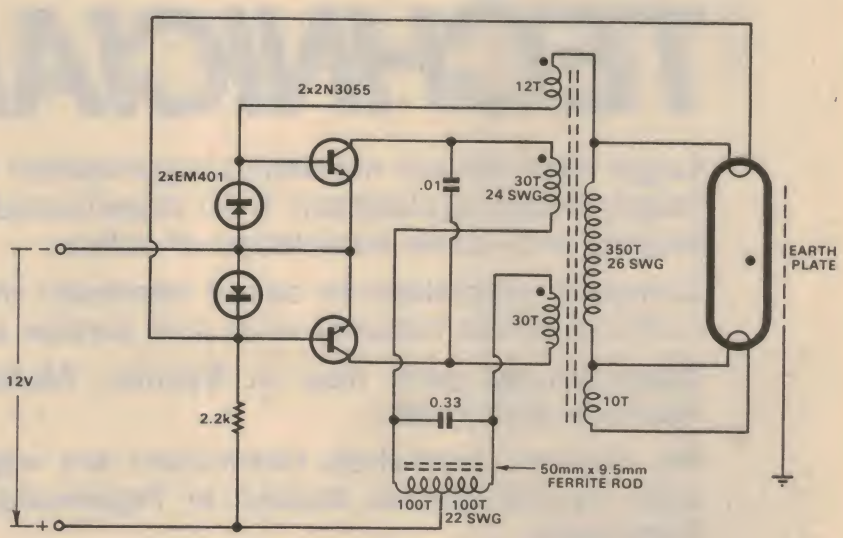
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

20W fluorescent inverter

A feature of this inverter is that it can operate at ultrasonic frequencies, thus making it inaudible. A more conventional inverter will normally oscillate at between 2 and 5kHz and emit a whistle which becomes intolerable after a short period. The circuit which I have designed is simple and efficient, is not critical in component tolerances and is easy to set up.

The circuit incorporates a 2-transistor DC to AC inverter with a ferrite pot core transformer. Inaudible operation is made possible by means of an inductor and capacitor connected in the primary side of the transformer, between the collector windings and the positive terminal of the battery. There is no ballast in the secondary circuit. The inductor consists of 200 turns of 22SWG enamel wire on a 5cm length of ⅜in ferrite rod, centre tapped, with the tap connected to the positive terminal and the ends connected to the collector windings.



The inductor/capacitor combination acts both as a ballast and as a tuned circuit, to control the operating frequency of the circuit under load. This frequency can be varied over a wide range simply by varying the value of the 0.33uF capacitor. To increase the frequency reduce the value of the capacitor and vice versa. Changing the capacitor within limits does not affect very much the current drawn from the battery or the power delivered to the load. On the other hand, the power delivered to the load is determined by the number of turns of the inductor, and the battery voltage.

In practice the highest operating frequency obtainable will be limited by the transistor capabilities. With readily available 2N3055s, the circuit will operate reasonably efficiently at about 16kHz (which is about the frequency with the component values shown) but for much higher frequencies it would be better to substitute transistor types with faster switching speeds. Using transistors with an Ft of better than 2.5MHz I have had no trouble in getting efficient operation up to 30kHz, simply by replacing the 0.33uF capacitor with one of about 0.22uF.

A 0.1uF capacitor is connected across the collectors of the two transistors. The actual value is not critical but without it the circuit efficiency may drop with consequent overheating of the transistors. The remainder of the circuit is relatively straightforward except perhaps for the unusual arrangement whereby one of the lamp heaters is connected in the base drive circuit. This arrangement eliminates the need for the usual resistor in this part of the circuit and in fact, adds to the overall efficiency of the circuit. To further increase the efficiency, the other heater may be switched out of circuit once the lamp has lit, or it need not be driven at all as far as starting the lamp is concerned, although I understand that such practice may result in reduced lamp life.

With regard to the transformer almost any grade or type of ferrite core can be used, provided that it is sufficiently large to contain the windings. The core that I used has an outside diameter of about 35mm but I have been unable to determine its grade. The circuit seems to work as well with a core having a gap as one which does not and so whichever kind is available should do.

Finally, this circuit also has the advantage that it is virtually short-circuit proof since a short placed across any of the transformer windings will stop the circuit from oscillating.

(By Mr H. Nacinovich, Lot 2 Devlin Road, Castlereagh, NSW 2750.)

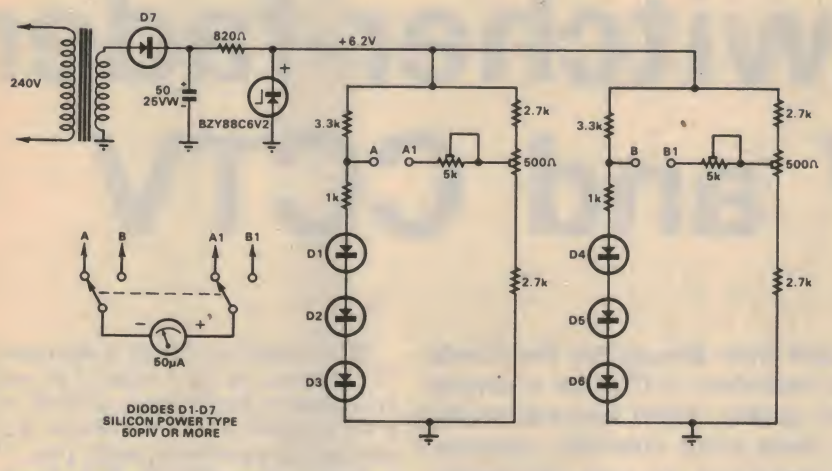
An electronic thermometer

A common topic of conversation is the weather, part of which is temperature. On contemplating this, I thought that it would be a good idea to buy a thermometer for my shack, rather than just guess as to what the temperature might be.

While pondering such an investment I considered that it would be a good idea to be able to read both inside and outside temperatures, the latter without shifting out of the shack. An article on the subject of thermometers was found in Electronics Australia, July, 1971. This article exploits the change in forward voltage drop across a silicon diode with change in temperature. This change in voltage is linear with temperature change, at least in the range of interest.

The above article then describes a practical instrument using an IC DC amplifier driving a 1mA meter. The article states however, that it may be possible to use a more sensitive meter movement and more than one diode, thus doing away with the IC. The design of my thermometer is based on this suggestion.

The circuit I used is simply two bridges with the facility of switching the meter to register one or the other. Three silicon diodes in series are used as sensor. The



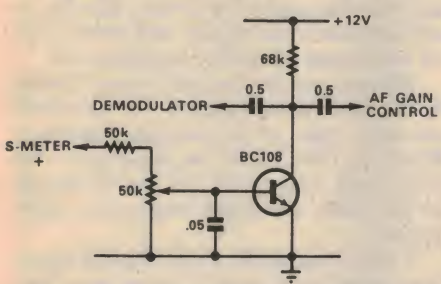
outside trio are located on the south wall of the house out of reach of direct sunlight and rain while the inside sensor is located on the back of the metal box which houses the other components. Wherever they sit they must not be directly influenced by heat from a transmitter or such but rather in a position which more fairly represents the ambient temperature of the room.

To calibrate the instrument I borrowed a couple of mercury thermometers, some ice from the refrigerator and an electric jug of water. Ice is packed in a cup along with a mercury thermometer and the diode sensors. The thermometer bulb and diodes are completely engulfed in ice, with the diodes connected to their respective bridges. As the ice melts there will come a time when the mercury will register 0 degrees C. Balance both bridges (500 ohm pots) so that the 50uA meter reads 0. Get the electric jug going and heat the water to a temperature a bit above 50 degrees C. Hold the diodes in the water, keep stirring the water and when the temperature falls to 50 degrees C adjust the 5k pots to read full scale on the meter. It pays to repeat this process perhaps a couple of times to ensure accuracy. You now have a 0-50uA meter reading 0-50 degrees C.

It is probably preferable to some to calibrate the instrument to read slightly below zero, possibly -10 degrees to +40 degrees, still using the same 50 divisions. I use a switch spring loaded in one direction so that the thermometer normally registers inside temperature. To conclude, this thermometer was fun to build, with no bugs and a reasonably useful gadget to have around.

(By D. Scott, ZL2AJO, in "Break-In".)

Simple muting switch



My first, dictionary-aided attempt to tackle an article "Einfache Rauschperre" by Wolfgang Hamer, DL1FN came up with the rather surprising translation of "plain open-wide intoxication" but since the circuit diagram did not seem to include any "bottles" I soon decided that "simple muting switch" is perhaps rather nearer the "mark".

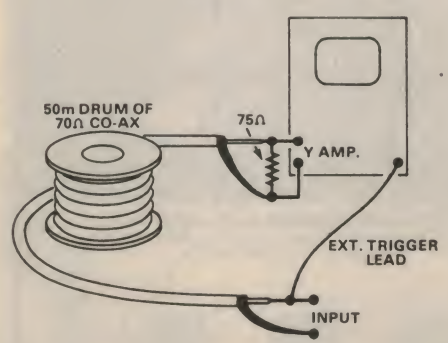
In fact, DL1FN suggests that a switch of this type, triggered by a carrier, is a useful aid to anyone wishing to quietly monitor a VHF channel. The transistor forms an electronic switch which short-circuits the bulk of the AF signal until the arrival of the carrier removes the short-circuit from the audio. The system can be adjusted to trigger on carriers of a wide spread of signal strengths. DL1FN adds the warning that the 12V supply for the BC108 needs to be completely ripple free since any hum will be amplified by the receiver AF stages.

(From "Radio Communication".)

Delay line for CRO

The advantages of a delay line for CRO pulse work are many, the main one being that a signal can trigger the timebase, and then, when it is running, the signal arrives at the Y plates. There are several good scopes around with quite wide bandwidth, but lacking a delay line, and so are limited in their applications to pulse work. However, coaxial cable can be used for delay purposes. Standard 70 ohm cable is suitable and has a wave velocity factor of about 0.66. This gives 195m of cable for a 1uS delay or, for the more usual 250nS delay, a cable length of 48m, which can be conveniently bought as a 50m drum of cable and left coiled on the drum,

It is necessary to load the cable at either the scope or source end with a 70 ohm resistor to prevent reflections. In use, one end of the cable is plugged into the scope input socket and the signal is applied at the other end. The timebase is set to external trigger and the trigger lead is connected to the source end of the cable. The diagram shows the general idea. (By Alan Ainslie, in "Practical Wireless".)



For the advanced amateur:

Video switcher-fader for ATV and CCTV

The video switcher/fader unit described here should fill the needs of amateurs and owners of video tape recorders (VTRs) for a simple and inexpensive design of professional quality. Main features of the unit are fully synchronized operation, three input channels, preview outputs, and direct coupled controlled amplifiers for wide bandwidth and low phase shift.

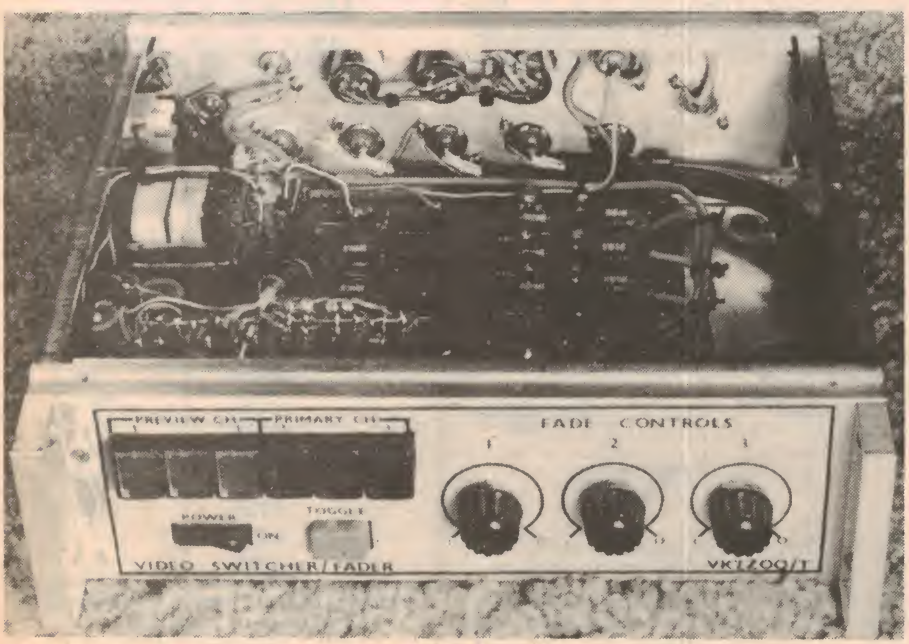
by IVAN G. REPIN (VK2ZOQ/T)*

The video switcher/fader unit to be described is inexpensive and uses readily available components. As presented here, the unit has been specifically designed for use with a sync generator. However, additional circuitry is presented to allow the unit to be locked to the mains, enabling simple mains locked CCTV cameras to be used. A three channel unit is described, although the circuit may be easily expanded to any number of channels.

Each channel of the unit consists of a controlled amplifier stage which is switched on and off by a DC voltage from the Q-bar output of an associated control flip-flop. This flip-flop receives its clock pulses from a sync generator via an inverter stage, and hence will only respond to input changes during the field blanking period. In other words, the unit will finish the field on the previous channel before starting a new field on the next selected channel, the switching being carried out during the blanking interval.

Each control flip-flop is directly coupled to a memory flip-flop, and these are controlled in turn by the front panel primary selector switches. These switches set the input logic states for the memory flip-flops. Clock pulses for the memory flip-flop come from a single-shot pulse generator driven by the toggle pushbutton on the front panel.

*24 Benelong Crescent, Bellevue Hill, NSW 2023.



The completed switcher-fader, shown with cover removed.

When a selector button is depressed, a "1" is placed on the J input of its associated memory flip-flop and, as the K input is permanently at "1", it will now change state on the arrival of a toggle pulse. The control flip-flop will now change state in sympathy when the next field drive pulse arrives, and hence switches its associated controlled amplifier on (logical "O" on Q-bar output of control flip-flop—channel on).

If the toggle switch is depressed a second time, the memory flip-flop will revert to its reset state, with "O" on the Q output. When the next field pulse arrives, this causes the control flip-flop to change state once again, and hence turn its associated controlled amplifier off.

When a primary channel selector button is disabled (button out), a "O" is placed on the J input of its associated memory flip-flop. This holds the flip-flop in the reset state, with a "O" on the Q output. In this state, it will not respond to toggle pulses.

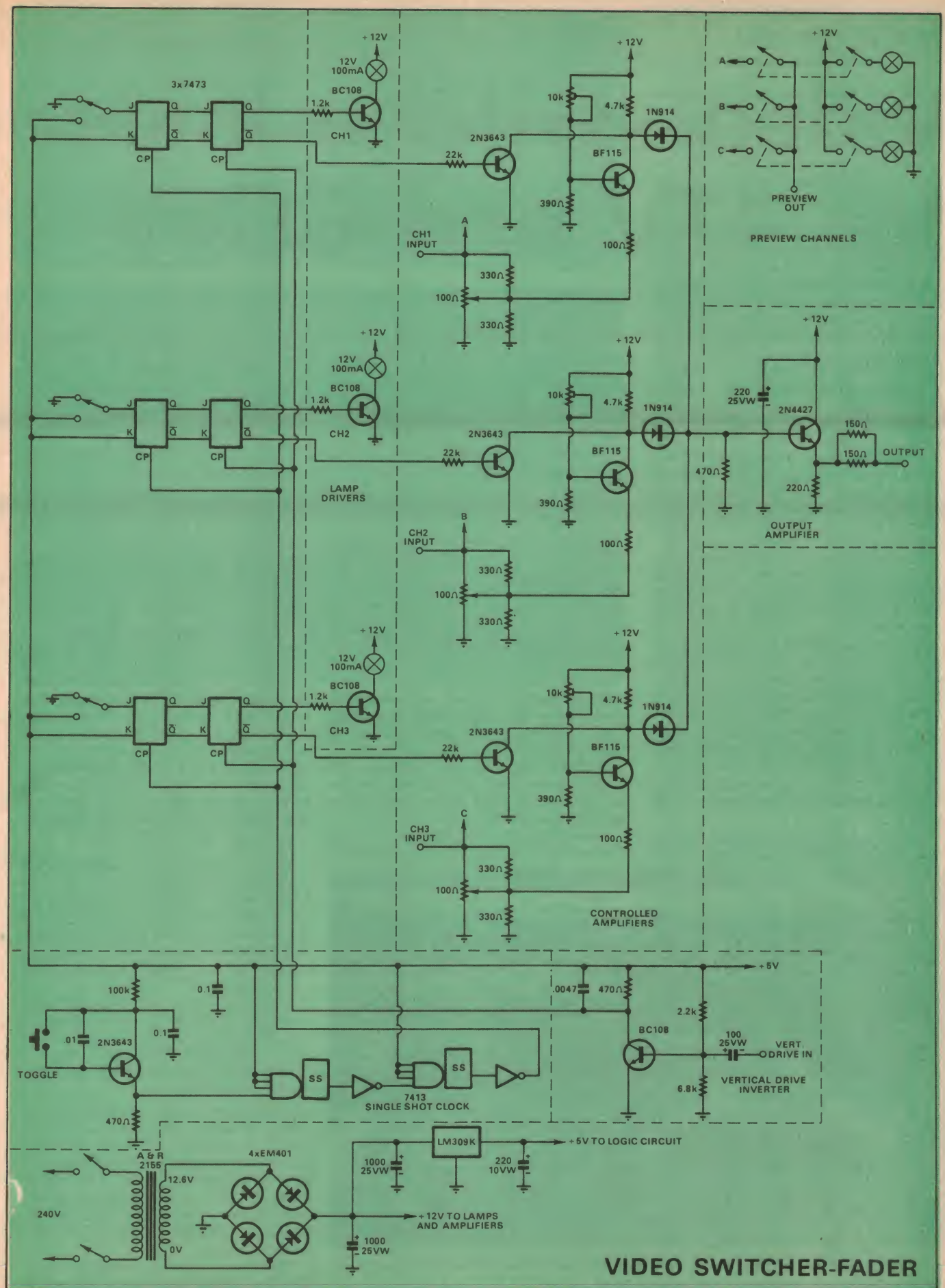
Visual indication of the channel in use is provided by a lamp in the selector button. This lamp is driven by a transistor from the Q output of the control flip-flop.

Construction of the unit is quite straightforward, with most of the circuitry including the controlled amplifiers, the output amplifier, the lamp driver circuitry and the logic circuitry, on one large PC board. The power supply circuitry is contained on a length of tagstrip mounted on the left hand side panel of the case together with the power transformer (see photographs).

Note, however, that several other components are also mounted off the PC board. In particular, these include a 330 ohm resistor connected between the signal input and the wiper of the 100 ohm linear pot for each channel of the fade control circuitry, and the 0.01uF polyester capacitor which is mounted across the toggle switch.

Components on the PC board are all conventional, and call for no special comment. Observe the usual precautions with regard to polarity of electrolytics etc. Note that a small clip-on, finned heatsink should be fitted to the 2N4427 output transistor.

I recommend that all interconnections


3x7473
+12V
12V 100mA
BC108
1.2k
CH1
2N3643
22k
10k
4.7k
1N914
BF115
390Ω
100Ω
CH1 INPUT
330Ω
100Ω
330Ω
PREVIEW OUT
PREVIEW CHANNELS
CH2
CH2 INPUT
CH3
CH3 INPUT
LAMP DRIVERS
CONTROLLED AMPLIFIERS
220 25VW
2N4427
150Ω
OUTPUT
470Ω
220Ω
OUTPUT AMPLIFIER
+5V
100k
0.1
.01
TOGGLE
.0047
470Ω
2.2k
100 25VW
VERT. DRIVE IN
6.8k
VERTICAL DRIVE INVERTER
SS
7413
SINGLE SHOT CLOCK
A & R 2155
4xEM401
240V
12.6V
0V
LM309K
+5V TO LOGIC CIRCUIT
1000 25VW
220 10VW
+12V TO LAMPS AND AMPLIFIERS
VIDEO SWITCHER-FADER

to the board be made via PC stakes (or pins) such as McMurdo type 4737-04-08. With stages in place, it can be dropped into place in the chassis and connections conveniently soldered to them. There are several wire links on the PC board, and these are clearly shown on the board wiring diagram.

Construction of the unit should begin by fitting the sockets to the back panel, the front panel controls, and the power supply circuitry. In all, there are 11 sockets fitted to the back panel: 3 source input sockets, 1 main output socket, 2 blanking drive input sockets, 3 camera drive output sockets, and 2 preview output sockets. The preview selector switches connect the preview out sockets to the various channels at their inputs.

Interwiring between the PC board, the input and output sockets, and the front panel controls should present no problems to the experienced constructor. However, we have prepared wiring diagrams for the preview channel and primary channel selector switches, and this should make the wiring detail somewhat less tedious.

The metal case used for the prototype was a Horwood type, the approximate dimensions being 25.4 x 22.9 x 7.6cm. Metalwork details are left to individual constructors.

After the unit has been completed and carefully checked, power may be applied and the unit checked for proper operation. However, before switching on, press the CH1 preview button and apply a 2V P-P square wave to the vertical blanking input.

On switching on, the Ch1 preview button should light and all other buttons should be out. If any of the main channels light, interchange the connections to the switch.

Now depress all main channel buttons and press the toggle button once. All main channels should come on, and should all go off when the toggle button is pushed again. The preview buttons should all light when pressed.

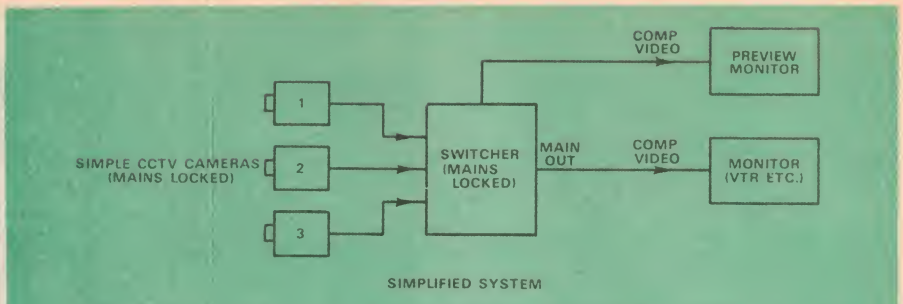
With the logic circuitry working, the controlled amplifier bias should now be set. This can be done in two ways, either visually or preferably, with a CRO.

Assuming first of all that you do not have access to a CRO, connect the sources to be used with the unit to the inputs. Switch each channel on in turn and adjust the bias controls until the picture is slightly more contrasty than for a direct patch (ie. gain approx. 1.3). Each channel should be adjusted for the same gain with the fade controls turned full on. Note, however, that white clipping will occur if the gain controls are advanced too far.

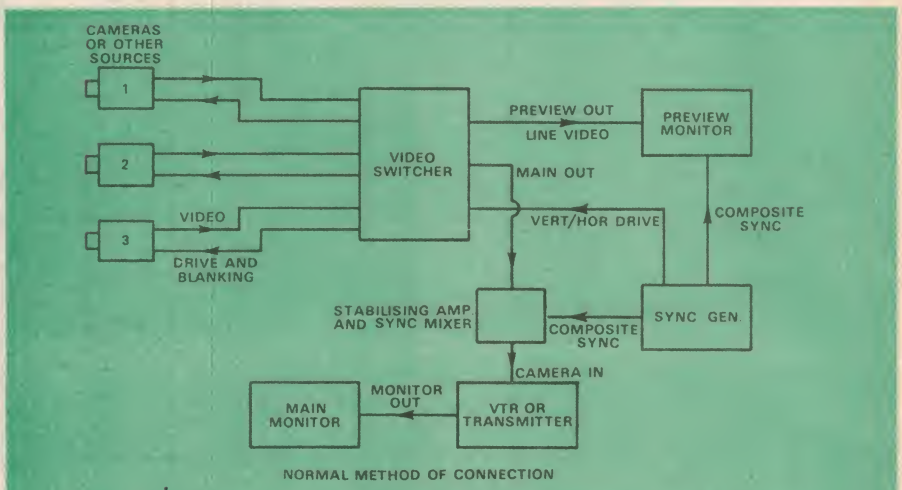
If you have access to a CRO, connect the inputs as above and connect the CRO to the output across a 75 ohm resistor. Adjust the bias controls until the tips of the blanking pulses (or sync pulses if using composite video) are at OV with the fade controls full on. Check this adjustment for all combinations of channels and compromise if necessary. With the extra gain provided by this unit, slight clipping of the blanking pulses can be tolerated. A slight variation from zero level is unavoidable, but this can be minimised with careful set-up.

It must be stressed, however, that this circuit is highly dependent on the DC levels on its inputs. This means that to avoid readjustment each input must be used only with the source it was set up with, or one with the same DC characteristics. Be warned, also, that the unit could be damaged by excessive input voltages.

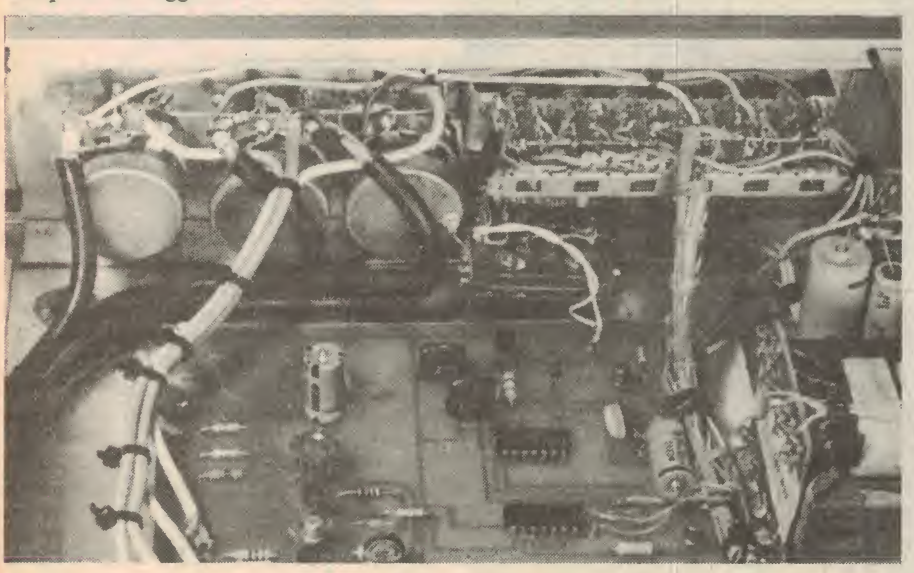
Operation of the unit is quite simple. The first channel required is selected by



Use of the switcher-fader in a simple mains-locked CCTV or VTR system. Both preview and main outputs use composite video.



Use of the switcher-fader in a more elaborate system. Here the switching is done before sync insertion.



A view showing the components on the rear of the front panel. Note that the prototype used ganged pots, because these were at hand.

depressing the appropriate primary channel selector button. On pushing the toggle button, this channel will be displayed on the main monitor. The next channel required is then selected (the previous channel can either be released or left depressed) and, on pressing the toggle button, the unit will switch over to the new channel.

Assume that the first channel selected was left depressed when the second selected channel button was depressed, and that the second channel is being displayed on the main monitor. If we press the toggle switch once again, the unit will switch back to the first channel, and will continue to switch between the two channels each time the toggle switch is activated.

Should you now wish to select the third channel, simply depress the appropriate selector button; at the same time, release the unwanted channel button. This latter step is necessary, otherwise the unwanted channel will be displayed together with the wanted one. Depressing the toggle switch will then switch the unit over from the channel in operation to the third selected channel.

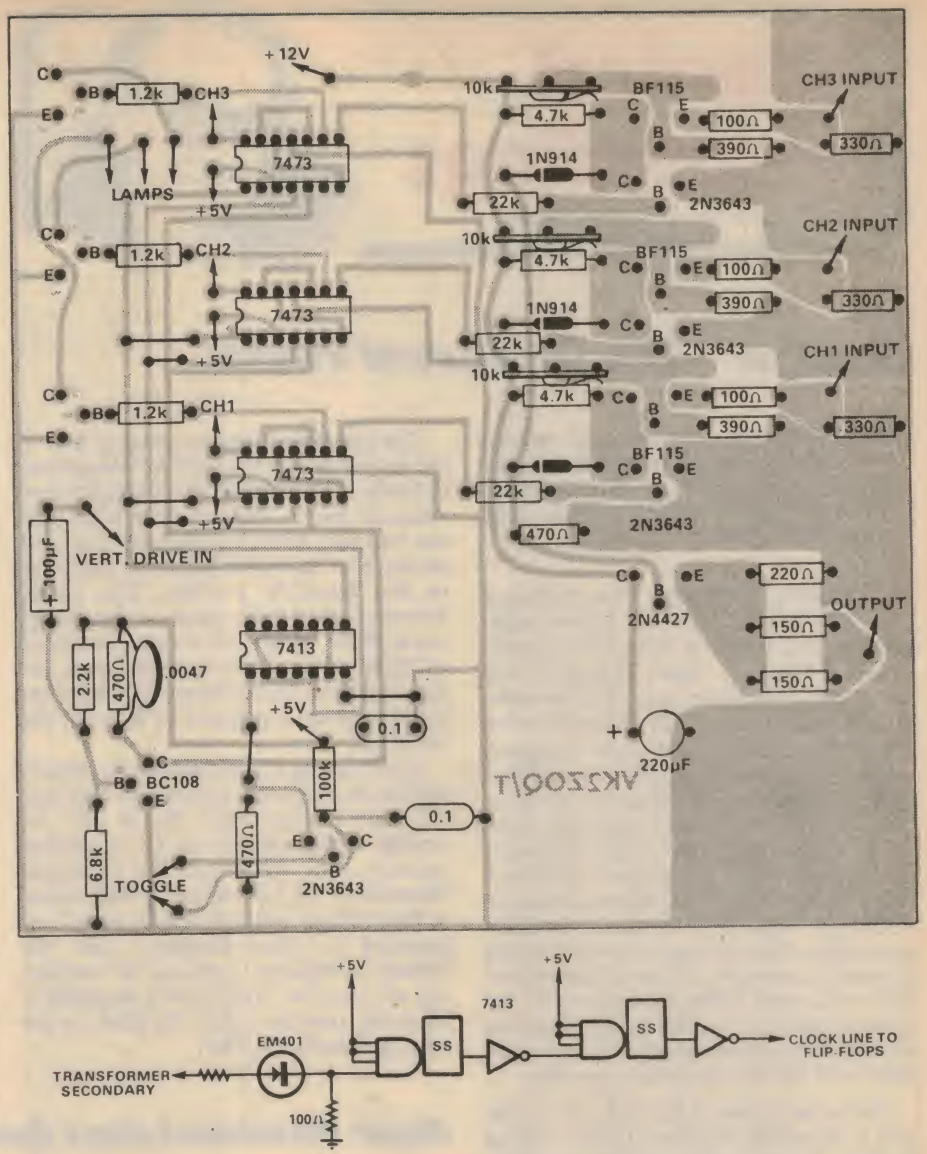
The important points to remember regarding operational procedure are:

- the release of a channel selector button does not turn that channel off until the toggle switch is activated; and
- depressing a channel button does not turn the selected channel on until it is activated by the toggle switch.

Obviously, if operational procedure involves selecting two (or more) channels in sequence, and then activating the toggle switch, those channels selected will be displayed together (or superimposed on one another). The relative levels of each channel are controlled by the fader controls. Signals are then passed from the unit to a VTR or transmitter via a separate stabilising amplifier and sync mixer.

Finally, the unit may be operated by remote control by fitting a remote switch across the toggle switch. Wired in this fashion, the unit may be switched between two preselected primary channels from a remote location.

EDITORIAL NOTE: The author of this article has indicated that he is willing to supply printed circuit boards and "Scotchcal" front panel labels for the unit described. Constructors who are interested in purchasing the above items should contact the author at the address supplied.



At top is the wiring diagram for the PCB used in the switcher-fader, to guide you in component placement and wiring. Note that the author will be able to supply PCB etching patterns. Immediately above is the suggested circuit for deriving the flip-flop clock pulses from the mains, for a simple mains-locked CCTV system.

PARTS NEEDED FOR THIS PROJECT

1 Transformer, 240V primary, 12.6V secondary, A&R 2155 or similar
1 metal case (see notes)
1 front panel (see footnote)
1 on-off mains switch
1 6-unit pushbutton switch assembly, illuminated, 3 yellow, 3 blue, 4-pole double throw, McMurdo
1 SPST pushbutton toggle switch
8 coaxial sockets, SO239
3 3-pin Cannon sockets
1 rubber grommet
1 mains cord and plug
1 mains cord clamp
1 3 terminal block, 240V
3 knobs to suit
1 printed circuit board (see notes)

SEMICONDUCTORS

4 EM401 silicon diodes or similar
3 1N914 silicon diodes
1 LM309K IC
1 7413 IC
3 7473 ICs
4 BC108 transistors
4 2N3643 transistors
3 BF115 transistors
1 2N4427 transistor

CAPACITORS

3 100 ohm, 2 150 ohm, 1 220 ohm, 6 330 ohm, 3 390 ohm, 3 470 ohm, 3 1.2k, 1 2.2k, 3 4.7k, 1 6.8k, 3 22k, 1 100k
3 10k preset tab pots
3 100 ohm linear carbon potentiometers

RESISTORS (½W, preferably 5pc)

2 1,000uF 25V electrolytics
2 220uF 25V electolytics
1 100uF 25V electrolytic
2 0.1uF LV polyester
1 0.01uF LV polyester
1 0.0047 LV polyester

MISCELLANEOUS

Brass spacers, machine screws and nuts, washers, coloured hook-up wire, shielded cable, tagstrip, rubber feet.

Classical Recordings

Reviewed by Julian Russell

Grainger—The Orchestral Works

GRAINGER—The Orchestral Works (Vol. 1) played by the Sydney Symphony Orchestra conducted by John Hopkins. 12 short pieces. World Record Club Stereo No. S/5257. (See footnote).

To the man in the street, Percy Grainger is probably Australia's best known composer of serious music. One of his pieces, Country Gardens, comes regularly over the air as a signature tune. Yet he wrote a great deal of music, very little of which is played nowadays, and some very good stuff you do not hear at all. You will find some of his lesser—or unknown—pieces on this disc, and very good, vigorous, fresh sound they make. The whole exercise is so enjoyable that I hope this Volume I will soon be followed by others. Grainger, without going to the extremes of atonalism and other dire alternatives was a really ingenious innovator. His arrangements of folk music add harmonic interest to the original without ever damaging their true character. His orchestration, too, is always lucid and full of delightful surprises.

Those who knew him well tell me he was a charming ebullient fellow, full of high spirits and quite uninhibited about displaying them. His mind was an original one which even before it had matured had already thrown off the influences of one of his most famous teachers, Busoni, and any evidence of a long and friendly association with Grieg.

So far as I can ascertain, he was the first English-speaking composer to indicate his musical directions in colloquial English instead of in Italian, French and German as was then customary. If he wrote "louden lots" players might have looked at the score with raised eyebrows, but there was no mistaking the fact that Grainger meant "Crescendo". A shameless extrovert he revelled in using "modern" effects. He would bang the piano lid with his fist or pluck the strings inside with a fingernail long before this became common practice in Darmstadt, Donauschingen and other present day centres of avant garde activities. He even dabbled in electronic sound and incorporated into his scores parts for harmoniums, concertinas, musical glasses—in fact almost anything that could produce a note, or even sound. His vitality was immense, his appetite for work prodigious.

The late Percy Scholes wrote of him in the first edition of the Oxford Companion to Music: "Everything he (Grainger) says, writes or does is different from what anyone has said, written or done before—one example of this trait being his marriage to the Swedish poetess, Ella Viola Stromm, which took place in the Hollywood Bowl before an evening audience of 20,000 people, for whose pleasure, before and after the ceremony he conducted a Bridal Song composed by him for the occasion".

After Grainger had become an American citizen Australia saw little of him save for brief, hurried visits. But in 1935 he earned enough money on an Australian country tour to found the Grainger Museum in the University of Melbourne. A fine fellow was our Percy and I am grateful to John Hopkins and the Sydney Symphony Orchestra for reminding me just how vividly alive so much of his music remains today. He died, by the way, in America in 1961.

The disc under review offers 12 short items all off them splendidly played and very faithfully recorded. It starts with the evergreen Country Gardens and then goes on to a Harvest Hymn (for strings) which sticks closely to English examples of the form with added interest in the change of scoring and harmonisation of the first and second parts, the second having been written 27 years after the first.

There is a strange change in the acoustics when unaccompanied baritone Ronald Jackson and mezzo-soprano Lauris Elms start the next item, Under a Bridge. A gamelan-like combination of tuned percussion later enters to support the singers, who are in very good form. Their diction is impeccable—necessarily so. And the orchestral epilogue is quite contemporary to the present day ear. Follows a cheeky little march full of the most beguiling orchestral enterprises. You can't afford to let your attention wander for one instant in case you miss something even more ingenious in the next. Further on Ronald Jackson and Lauris Elms sing made-up monosyllables in a folk song type of tune supported by an exquisitely scored accompaniment. Throughout this long but never monotonous recital there was only one item that dissappointed me, Shallow Brown, in which baritone Christopher Field sings in a throaty, lifeless English oratorio voice.

In all these pieces Hopkins identifies himself completely with every change of mood and has the knack of choosing perfect tempos. The disc was produced by the Australian Broadcasting Commission and is such a fine example of Australian music-making in all its aspects that it deserves wide circulation abroad.

Roger Woodward plays Beethoven

BEETHOVEN—Piano Sonatas Op. 111 in C Minor and Op. 57 in F Minor (Appassionata) played by Roger Woodward. RCA Stereo LRLI-5016.

There is sometimes something so wilfully different about Woodward's playing of the established piano repertoire that it borders on the perverse. He often seems to be seeking—and claims to find—an aspect of a composer's work never noted by any previous performer. With a terrific technique such as Woodward has at his command, almost anything might happen—on the concert platform or in a recording studio. He frequently comes close to intellectual bullying to make his point.

On the concert platform things seem arranged to impose a respectful and receptive mood on his audience. In a half-lit hall—I have in mind his recitals in the Concert Hall of the Sydney Opera House complex—the piano stands alone on the stage with a solitary, not too bright, spotlight on it.

Before his entrance everything on the stage is so reverentially quiet and motionless that it is easy to imagine a body lying in state inside the opened instrument. Woodward appears, bows low to the four points of the compass, seats himself, pauses a moment in thought, then starts. What follows might be enchanting—or very disturbing indeed. And this strange inconsistence persists throughout the recital. But it is no accident for it is immediately obvious that he has rethought the work he is going to play and often comes up with his own intensely individual interpretation. In his own sleeve notes on the pieces on this disc, and his thoughts on music in general are not excepted, he states that he has re-examined Beethoven's manuscripts and found discrepancies between them and published scores and claims to have reverted to the manuscripts on which to base his interpretations.

Why then does he ignore some of the composer's own markings and substitute an idea of his own? As an example take the opening of the Appassionata marked allegro assai, but which he plays with slow, weighty earnestness. Beethoven's meaning in this movement has always been clear with its outbursts of bashing rage interrupted here and there by tender musings.

Where are they here? Instead you have the impetuous crockery-throwing Beethoven doing an uncharacteristic slow burn. Yet in the following slow movement Woodward offers playing as lovely as anyone could desire—only to revert to an eccentrically slow Finale. By the way, there is never any doubt that Woodward's technique could easily deal with a much faster tempo. One might well ask why. And my reply would be that only Woodward knows and can readily come up with a plausible if perhaps unconvincing explanation.

Now something new does not necessarily mean something good. There is little merit, in this context, in novelty itself unless it is illumined by some inspired insight overlooked for generations by other performers of the work. Hence my admiration for and enjoyment of much that Woodward does is frequently tempered by uneasiness about what he might do next. You can hear some of these oddities in the Opus III. The opening is of truly impressive dimensions but the perfect articulation of every note in many of the fast passages I find disturbing and also unatmospheric. But go on to the Arietta and you will hear playing so seraphic that it lifts you airborne with it right up into the empyrean. Here are two performances that never fail to compel attention though I cannot say the same about approval. Try them for yourselves. Could there be a generation gap between me and the very much younger Woodward, although I disclaim any such gap between myself and the composer. To me the gap seems to be Woodward's in his attempts to bring the old chap up to date with mid-20th century youthful ideas. If you have been hypnotised by the strength of Woodward's personality in a live performance to the extent of approving everything he does, play these two sonatas without his persuasive presence. You may well be surprised.

★ ★ ★

DVORAK—Serenade for Strings in E Major.
ARENSKY—Variations on a Theme by Tchaikovsky. English Chamber Orchestra conducted by Johannes Somary. Vanguard Quadrophonic VSQ 30011, Stereo VSD 33020.

In the top left hand corner of the back of the sleeve of this disc is the word quadraphonic and in the right hand corner the word stereo. The record label reads quadraphonic/stereo. I thought at first that I had come across a quadraphonic recording made truly compatible with stereo. Further examination of the sleeve and label revealed that I had overlooked the fact that the quadraphonic and stereo processing systems each had its own number and that the version I had played was stereo processed. And this fact utterly destroyed my idea that I had been listening to stereo/quadraphonic compatibility.

The playing of both these works is all I had come to expect from the English Chamber Orchestra—unfailingly accurate and always sensitively responsive to direction. But in the Dvorak the playing, although carefully graded in dynamics and tempos, sounds a bit routine with much of the music resembling good Palm Court style and certainly not top-drawer Dvorak. But I don't think this was responsible alone for my tepid response to such a well played work. There are, of course, passages of very great beauty. My interest quickened in the splendidly bright, rhythmic Finale with its recall of themes from the preceding movements.

In the Arensky Variations I felt the playing was much better attuned to the composer's spirit than in the Dvorak. By that I mean the spirit of both composers, Arensky and Tchaikovsky, who provided the theme for the variations. Arensky sustains Tchaikovsky's essence in a manner that carries complete conviction. The shortness of the individual variations helps in establishing ever changing moods that are very ear-satisfying indeed. This is the first recording of Somary's conducting I have so far heard and here he gives every indication that he will provide much that is well worth while hearing in the future.

★ ★ ★

SAINT-SAENS—The Five Piano Concertos. Aldo Ciccolini (piano) and the Orchestra de Paris conducted by Serge Baudo. Etude en Forme de Valse. Six Studies for the Left Hand. Aldo Ciccolini. World Record Club stereo S/5705/6/7. Three discs. (See footnote).

Of these five concertos the strongest survivor is the 2nd in G Minor, still often heard in concert halls. The next in continuing public approval is the 4th in C Minor. Not one of the concertos escapes occasional banality which can usually be forgotten in admiration of the accomplished workmanship of them all. The same might be said of most of the other music Saint-Saens wrote, and he wrote plenty.

I heard the Concerto No. 1 for the first time in this set and it gave me very pleasant surprise. First, there is none of the usual padding in the solo part, a merit it would be difficult to award to many other composers of concertos. The first movement is full of elegant vitality and Ciccolini plays it with a crystalline touch at the service of an unaggressive virtuosity. Try it. It's full of delights.

The 2nd movement may not be very profound but there is never a dull bar. A spirited but always perfectly controlled Finale is just right in form and execution to end this attractive, unassuming concerto.

The 2nd Concerto opens with a Bach-like theme followed by a lovely romantic melody romantically treated by the composer and his admirable interpretors. Now comes the scherzo, which I heard long before I ever heard the rest of the concerto in, of all places, the London Coliseum which was then a variety house during World War I. The pianist was Max Darewski and I remember well that he was received with respectful silence by an audience impatient to get on to the antics of Grock the clown. The scherzo is made up of a Mendelssohnian first subject and a delightful, still fresh rhythmic second subject. I can admit unrepentently that I still can get quite a thrill out of this movement, especially when it is played with as here. The final tarentella flashes by with never a moment's worry for the listener. It seems as unlikely that anything might go wrong as that the sun might rise in the west.

I'm afraid No. 3 is a dud. It starts, like Wagner's Rhinegold, right down at the bottom of the river and works its way up to the light. Substitute the Seine for the Rhine and you have it. In his unsuccessful attempts at profundity the composer is ungenerous to both soloist and orchestra. The first movement is lamentably short of good musical ideas. Moreover in this work surprisingly Saint-Saens joinery doesn't seem as neat as usual. Any remote possibility that it might one day win popularity has long since passed. The second and third movements provide little to enjoy except perhaps the interesting harmonies at the beginning of the 2nd movement.

Concerto No. 4 is still nearly as popular as the G Minor and is also often heard today. It has much the same merits as the latter named—pleasing themes seamlessly worked into expressive decorative movements. In this the composer still has something to say to properly trained contemporary ears.

Concerto No. 5 has been given the nickname of "The Egyptian" on the strength of a slow, eastern-type melody that Saint-Saens is supposed to have jotted down on a starched shirtcuff he was wearing while touring Egypt. The first movement is just a bore, but the 2nd improves though I cannot raise much enthusiasm for any of the work.

On Side 6 you have a Study in the Form of a Waltz, a trifle that might well warrant the attention of quite serious players as a possible encore. At the beginning the piano cuts off so abruptly that it might be due to a bad tape join, but on the whole I found the piece quite charming. The six studies for the left hand alone are also interesting, especially the first which sounds strangely guitar-like in its use of the middle register.

Still more intriguing is a little fugue which must be diabolically difficult to play with one hand, though you wouldn't think so when listening to the fluency and logic used by Ciccolini in its execution.

For information on World Record Club albums, contact the Club at 605 Camberwell Rd., Hartwell, Vic. 3124. Tel. 29 3636.

Variety Fare

Reviews of other recordings

Devotional Records

AND GIVE HIM PRAISE. Joyce Jones, organ. The Baylor University Chamber Singers conducted by Dr. Robert H. Young. Stereo, Word WST-8611-LP. (From Sacred Productions Aust., 181 Clarence St., Sydney and other capitals.)

From the title of this album one rather expects to hear a smallish choir backed with organ but that is not what transpires. The two things that the choir and organ have in common is that they are part of the Baylor University — and they share this disc! The 16-voice choir was recorded unaccompanied in the Meditation Foyer of an on-campus library, while the organ is a 61 rank Ruffatti instrument installed in the principal recital hall.

What you get on the disc, therefore, are alternate tracks of organ and choir which, for clarity, are listed as follows: Organ: Lobe Den Herm (Walther) — A Mighty Fortress (Walther) — Twilight At Fiesole (Bingham) — Fugue a la Gigue (Bach) — O World I Now Must Leave Thee (Brahms) — Rondo For Flute Stop (Rinck) — Chorale Prelude on "Seelenbrautigam" (Elmore).

Choir: Praise To The Lord — Prayer To Jesus — My True Love — Innsbruck — Darkness Was All Over — O Mistress Mine — The Blessed Son Of God.

While the complete segregation of choir and organ comes as a surprise, many may prefer it to a complete album devoted to one or the other. The musicianship is what one would expect from a specialist musical college, on an album produced by the well known Kurt Kaiser. The quality is good, provided one can accept the incidental noises which sometimes intrude on the softer passages from a large organ played in a large auditorium. (W.N.W.)

★ ★ ★

NEGRO SPIRITUALS. George Browne, Martin Lawrence, Isabelle Lucas, Geoffrey Taylor and the Linden Singers conducted by Bobby Richards. Stereo, World Record Club WRC S/2005.

This is a very old album but a quite unforgettable one. As the jacket notes point out, negro spirituals began a gradual change from their original simple form with the publication of the book "Slave Songs Of The United States" in 1868. Harmonies and arrangements beyond the resources of the negro slaves were developed around the original melodies, yet the emotional fervour was still there for the sympathetic performer.

And herein lies the appeal of this album by the Linden Singers. Soloists, chorus and orchestra communicate the basic fervour and conviction of fourteen well known spirituals but without the ethnic emotional extravagance and mannerisms to which many cannot respond:

Jericho — Nobody Knows The Trouble I've Seen — Little David — Sometimes I Feel Like A Motherless Child — Lily Of The Valley — Gospel Train — He's Got The Whole World In His Hands — Shadrak — Go Down Moses — Deep River — Sweet Little Jesus Boy — Heaven — Swing Lo Sweet Chariot — Standing In The Need Of Prayer.

I gave this album a "rave" review many years ago and I haven't the slightest reason to modify those remarks now. If you have a devotional collection without this one, you've been missing out. But it's a good one to have in any collection.

Despite its age, the sound is fine and the surface is completely clean. (W.N.W.)

★ ★ ★

ABIDE WITH ME. John Boulter, the John McCarthy Singers, Johnny Douglas and orchestra. Stereo, RCA Camden VCL1-7029.

One would gather from the Camden label and from the remarks in the jacket notes that this is one of John Boulter's earlier albums, made at a time when he was better known as a soloist in the TV "Black and White Minstrel Show" than as a performer in his own right. But don't let that mislead you. His earlier formal concert experience is very evident here in all those numbers which permit full use of his considerable vocal powers. The twelve titles:

Were You There? — Bless This House — O Perfect Love — It Is No Secret — Panis Angelicus — Ave Maria — The Lord's Prayer — The Old Rugged Cross — Steal Away — Agnus Dei — The Story Of The Sparrows — Abide With Me.

Soloist, chorus and orchestra combine well in an essentially formal performance of these hymns and sacred songs and its appeal will naturally be those whose tastes run in that direction.

If they do, you'll enjoy it (W.N.W.)

Instrumental, Vocal and Humour.....

SUITE FROM THE NUTCRACKER. Tchaikovsky's Greatest Ballets, Volume 1. Eugene Ormandy and the Philadelphia Orchestra. Stereo, RCA ARL1-0027.

When this album first goes on the turntable one may well listen to the sound, then look at the setting of the volume control and wonder whether or not there is something amiss. But, of course, as R. D. Darrell points out in his detailed jacket notes, the miniature overture has a delicate fairy tale quality that avoids the slightest suggestion of ponderous sound. But the sound rounds out with the emergence of the children's march, and the winter scene.

However, it is not until well into side 2, that the reason is evident for the initial restraint in the recording level, with sound that is of massive porportions. Fortunately, a very quiet surface and clean recording techniques have allowed the dynamic range to be captured, though I would have some apprehension about rumble in the quietest passages from anything but a very good turntable.

As mentioned before, the jacket notes are by R. D. Darrell and are obviously aimed at orientating those who, while familiar with the melodies, might welcome some guidance in the matter of orchestral structure and the ballet itself. I guess that most followers of classical music will already have their own and perhaps more favoured recording of this suite but, for those whose collections have a preponderance of other music, this recording by the Philadelphia and its equally well known conductor could be a worthwhile investment. (W.N.W.)

★ ★ ★

KILLING ME SOFTLY — Ferranti & Teicher — Stereo United Artists L 34986.

These piano duets with orchestral arrangements of tunes popular at the time of recording have been a regular twice yearly feature for at least ten years. This latest effort has Theme from Also Sprach Zarathrustra — Send in the Clowns — Killing Me Softly With His Song — Ben — Last Tango in Paris — The Summer is Coming — Lady Sings the Blues (Love

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

Theme) – Seesaw – Try Again – Night Sounds – Living Together, Growing Together – Don't Ask Me Why.

In the past the recipe has been large string section, playing lush arrangements, with highly decorated piano contributed, played with maximum smoothness. A noticeable difference here is the addition of a lively rhythm section. Gone is the soporific smoothness; one is only too well aware of the presence of the enthusiastic percussionist. Time will tell whether this treatment will gain Ferranti & Teicher a new generation of record buyers, or lose them a portion of the present one. (H.A.T.)

★ ★ ★

TURN YOUR RADIO ON. Ray Stevens. Stereo, Astor BR-5009. Also on musicassette ACT-2507.

In his day, evangelist Charles M. Alexander was regarded as a bit "way out" with some of his hymns like "Love Lifted Me", but Ray Stevens' trendy version of the same hymn might have been a bit much even for Alexander. I was wondering what Ray Stevens was going to do next with "Jesus Loves Me" but the old Sunday School perennial came through almost unscathed.

Basically, this album by Ray Stevens contains a variety of material and variety of styles, mainly centred on the kind of up-tempo treatment which will be familiar to the usual Saturday night Gospel rally audience:

Turn Your Radio On – Love Lifted Me – Yes, Jesus Loves Me – Let Your Love Be A Light Unto The People – A Mama And A Papa – Have A Little Talk With Myself – All My Trials – I'll Fly Away – Why Don't You Lead Me To That Rock – Glory Special – Oh, Will There Be Any Stars?

I wouldn't recommend this one to anyone with strongly conservative tastes in Gospel music but it should fit well into the average 'teen family situation. The performance is smooth and tuneful and the sound quality good. (W.N.W.)

★ ★ ★

PETER AND THE WOLF. Music by Prokofief. CARNIVAL OF THE ANIMALS. Music by Saint-Saens. Narrations by Beatrice Lillie. London Symphony orchestra conducted by Skitch Henderson. World Record club stereo S/4580.

Every child should be introduced to "Peter and the Wolf" at an early age. And this is an excellent version with Beatrice Lillie giving the narration in a vernacular which is sure to appeal to kids. "Carnival of the Animals" has an audibly most convincing menagerie to back up the music pictures. Beatrice quotes apt verses by Ogden Nash. Sound quality is good. Really quite an attractive production for what is really just a bunch of whimsy. (L.D.S.)

TONY MOTTOLA & THE BRASS MENAGERIE. Quadraphonic, Project 3, LQ 35183.

Enoch Light, Project 3 and Quadraphonic are now a familiar combination and this latest addition to the 4-channel repertoire features one of the top names recording on the Project 3 lable – guitarist Tony Mottola, backed here by the Brass Menagerie, a group of top ranking brass players.

This is typical Enoch Light fare, expertly produced for 4-channel and well recorded. Featuring as it does some of the latest hits and some popular evergreens, it should appeal to most adult tastes, particularly those who are partial to Tony Mottola's smooth guitar style. The tunes include Stella by Starlight – Daydream – Happy – Killing Me Softly – Day by Day – Malaguena – They Can't Take That Away From Me – Lost in the Stars – Hoe-down a Minute. (H.A.T.)

★ ★ ★

SECOND MILITARY DISTRICT BAND LIVE AT THE OPERA HOUSE. Festival stereo L 35302.

Sydneysiders have some very good brass bands in their midst, even if they are not aware of it. One of those is the Second Military District Band which has apparently had several names since its inception exactly one hundred years ago. (I believe most of the original members have retired!) Anyway, they demonstrate their versatility and musicianship very well on this record which has some lively arrangements of popular music. Record quality is very good.

A list of the tracks comprises: Big Country – Gershwin Medley – He Ain't Heavy, He's My Brother – MacArthur Park – Centenary Fanfare – Colonial Dance Memories – Peanut Vendor – Big Beat No. 1 – Black Bottom – Hot Canary – Jesus Christ Superstar. (L.D.S.)

★ ★ ★

EBB TIDE. Fantastic Strings Mood. RCA Camden Stereo VCL1-7028.

On the cover of this album is a picture of a lady up to her neck in cool blue water, but from the expression on her face its difficult to tell whether she is enjoying a dip in the briny or maybe she is discomforted with water up her nose. Ambiguous expressions aside, this is pleasant disc of easy listening with a large string orchestra. Record quality is okay. A good buy.

Twelve tracks are featured: Ebb Tide – Tiny Bubbles – On A Tropic Night – Beyond the Reef – The Hawaiian Wedding Song – Lovely Hula Hands – Pearly Shells – Some Enchanted Evening – Blue Hawaii – Hawaiian Paradise – Hawaiian War Chant – Aloha Oe. (L.D.S.)

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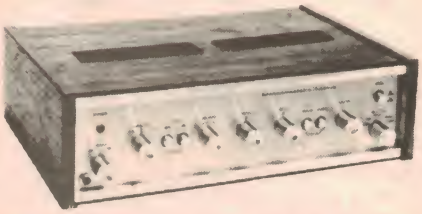

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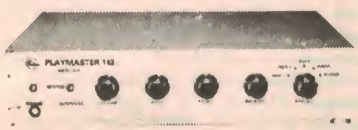

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VARIETY FARE

MAHLER. Original soundtrack from the film. Philips Stereo 6558 002 Phonogram Release.

I would prefer to forget the "soundtrack" part of the title of this fine record and regard it rather as a sampler of the symphonic style of Mahler. There are excerpts from eight of his symphonies played by the Concertgebouw Orchestra of Amsterdam under the baton of Bernard Haitink. The quality is superb, with sensible use of the stereo image. The segments in order are from nos. 10-3-5-4-3-1-6-7-3-5-1-7-3-5-9 and 6.

One criticism: from my viewpoint the jacket design is certainly not in keeping with the content. (N.J.M.)

★ ★ ★

TRUMPETISSIMO with Maurice Andre (trumpet), Wolfgang Karius (grand organ) Guy Pedersen (double bass) and Gus Waller (drums). Stereo, World Record Club WRC S/4988.

After a non-compelling start with "Air On A G-String", Maurice Andre settles down to five more melodies from J. S. Bach: Gavotte — Air-Duet — Badinerie — Choral — Bourees. Side 1 concludes with "Largo", from Vivaldi's "Four Seasons".

Seven tracks of a different nature occupy side 2: J'Ai Du Bon Tabac — La Mere Michel — Le Petit Quinquin — Greensleeves — Hop! Voila Mon Echelle — Silent Night — L'Amour De Moi.

Now quite an old recording from the Erato (Paris) label, the album is nevertheless very cleanly recorded, quite free from noise and distortion and with plenty of "bit" and presence in the trumpet. In fact, it is very much a trumpet virtuoso album with the remaining instruments in a strictly supporting role. An unusual recording, it nevertheless makes pleasant and interesting listening. (W.N.W.)

★ ★ ★

GOLDEN HOUR OF WALTZES. 101 Strings. Astor Golden Hour Stereo GH 829.

If you are keen on waltzes played by a large orchestra backed with an occasional chorus then this album will be your bag. I hate to sound a sour note but the recording quality is a little on the "edgy" side at times which will be noticeable on good quality equipment. Surface noise was negligible.

A whole bunch of tunes are played but space does not permit listing them all. Some are as follows: Vaya Con Dios — Sleepy Lagoon — Marmalade, Molasses And Honey — Beautiful Ohio — Dear Heart — Edelweiss — Sunrise, Sunset — Tenessee Waltz — Fascination — True Love. (L.D.S.)

The Morriston Orpheus Choir

CARTREF. The Morriston Orpheus Choir conducted by Lyn Harry. World Record club stereo S/5729

A really magnificent choir is the Morriston Orpheus — well disciplined and having the power and range of a large male choir—backed by an equally magnificent pipe organ at the New Siloh Chapel, Landore. But this choir does not merely treat material you would expect of a Welsh choir. Besides having a selection of negro spirituals they also give the treatment to "Exodus" and "Scarlet Ribbons".

To complement the fine singing is an excellent recording stand with a wide stereo spread. Really a record to show off your system.

A full list of the tracks comprises: Cartref (sung in Welsh) — The Huntsmen's Chorus (sung in German) — Morte Christe (sung in English) — Little Innocent Lamb — The Land Of Song — The Bandit's Chorus — Unwaith Etto'n Nghymru Anwyl (sung in Welsh) — Exodus — Tros Y Garreg (sung in Welsh) — My Lord What A Mornin' — Scarlet Ribbons — Kalinka (sung in Russian). (L.D.S.)

EL CONDA PASA. Au Son De la Flute Indienne. Barclay Stereo L 35236.

A breathy flute, two guitars and harp comprise this curious group from South America. Their music has a pleasant quaint quality which is very attractive. At times its liveliness is very similar to that of a Greek band such as the "Athenians" for example. Sound quality is excellent.

Tracks include: El Condor Pasa — Tres Bailecitos — Copacabana — Chaya De La Soldad — Sombras — Corapy Ajeno — La Barca — Selection De Bailes Incas — Kenas — Negrita — Danznte Del Destino — Desde Santa Cruz. (L.D.S.)

★ ★ ★

BARRY CROCKER'S GOLDEN HITS. Festival L25161 Harlequin Series.

Barry Crocker certainly sheds the 'Bazza MacKenzie' image in this collection of fifteen of his best known vocal hits, some of the titles are: Susie Darlin' — Please Don't Go — I'll Catch The Sun — I'll Walk With God — Music Makes My Day — Wheeling West Virginia — This Guy's In Love With You — What Are You Doing The Rest Of Your Life.

The unnamed backing group and orchestra do a first class job. Coupling the vocal skill of the artist and the budget price of $3.99 makes this record well worth a hearing for ballad lovers. (N.J.M.)

★ ★ ★

THE VOICE OF THOMAS EDMONDS. RCA SP-148 Stereo

Anyone who has watched the 'Showcase' series on TV will remember Thomas Edmonds who won both the judges' award and the audience award in 1968, effectively launching him on a professional career. Most of the tracks are musical comedy favourites, grouped with more recent titles such as "The Exodus Theme" and "Lara's Theme" from Dr Zhivago.

Others on the record are: I Talk To The Trees — Danny Boy — Till There Was You — You Are My Heart's Delight — The Donkey Serenade — Sunrise, Sunset — Serenade — Moon River — If I Loved You — Goodbye.

The orchestra is conducted by Rocky Thomas and the quality is good, making the record a must for ballad lovers. (N.J.M.)

VARIETY FARE

YOU SMILE—THE SONG BEGINS. Herb Alpert with the T.J.B. Stereo, A. & M. Records L 35167.

Herb Alpert's later records were never comparable with his early efforts. The bubbling gaiety and infectious joie de vivre of the first four or five albums were replaced in subsequent discs by a growing sense of boredom. The sparkle was gone—it was like flat champagne and just as edifying. Now after a long interval, Herb is having another try. My advice is, if you are an early Alpert fan, forget it!

This new release has all the characteristics of the immediate predecessors, plus a distinct air of nostalgia, a kind of wistful awareness of past successes which cannot be recreated.

The titles include: Fox Hunt—Up Cherry Street—Promises, Promises—Dida—Alone Again, Naturally—Last Tango In Paris—12 tracks in all.

Alpert fans who are tempted should try to sample before buying. (H.A.T.)

★ ★ ★

URBIE GREEN'S BIG BEAUTIFUL BAND. Project 3 stereo L 35245. Festival release.

Combine the recording brilliance of the Enoch Light group and the musicianship of some of the big names in jazz and you have an exciting sound indeed.

The seven long tracks are: Sing—Ana Luiza—Summertime—Alone Again, Naturally—St. Louis Blues—A Very Precious Love—What Have They Done To My Song, Ma?

Some of the personnel listed are: Marvin Stamm, Bob McCoy, Mel Davis, trumpets; Wayne Andre, Buddy Morrow, Paul Faulise, trombones; George Young, Eddie Daniels, Danny Banks, saxes: Richard Davis on bass; Grady Tate, drums and Tony Mottola, guitar. The sleeve notes suggest a Basie influence and this shows through quite strongly on most tracks. Quality really good. (N.J.M.)

★ ★ ★

WATCH OUT. Baja Marimba Band. World Record Club stereo S/5367.

A fun album from the melodic and rhythmic Baja Marimba band. Very enjoyable for dancing, dining or even doing the washing up! Record quality is good.

Eleven tracks are featured: Portuguese Washerwoman—The More I See You—Sabor A Mi—Yours—Cast Your Fate To The Wind—Somewhere My Love—Gay Ranchero—Spanish Moss—Telephone Song—Tomorrow Will Be Better—Ghost Riders In The Sky. (L.D.S.)

★ ★ ★

INTERNATIONAL HITS. Daniel Armas. Stereo, Interfusion (Festival) L-35089.

Recorded originally in Mexico, this album features the orchestras of Pedro Mesias, Bebu Silbeti, and the Los Kleiner Choir and Little Women. Featured artist is Daniel Armas, playing an instrument similar to the one-time mandolin guitar. Festival advise that it is a psalterio, presumably closely related to the ancient psaltery.

It's all very Mexican except for the range of musical themes which explain the title "International Hits": Last Tango In Paris—Aranjuez Concert—Hava Naguila—Venetian Anonymous—Lara's Theme—When The Sea Breeze Played With Your Hair—Concerto For One Voice—Zorba The Greek—Alone Again—The Wedding Of Luis Alonso.

A relatively uncomplicated sound, invoking mental pictures of Mexico, it may well appeal as a pleasant change from the more usual arrangements. The recording itself is very clean. (W.N.W)

BILLY 'CRASH' CRADDOCK—Rub It In. Probe Records SPBA 3077. EMI Release.

I somehow remember 'Crash' Craddock as one of the early rockers but on this record he comes through as a fairly straight country stylist, with such titles as: Rub It In—Walk When Love Walks—Ruby Baby—Stop, If You Love Me—Farmer's Daughter—Quarter Til Three—Walk Your Kisses—It's Hard To Love A Hungry, Worried Man—Arkansas Red—Home Is Such A Lonely Place To Go.

The rock touches are still there on some tracks and the sound is of the high technical standard we've come to expect from some of the Nashville studios. For those interested the record sleeve carries a full list of the backing musicians. (N.J.M.)

★ ★ ★

BILL EVANS. The Village Vanguard Sessions. Milestone stereo L 45335/6. Two record set $7.95.

The way the sleeve notes are written on re-issued albums of jazz artists you would think they were sanctified. In reality, most of them just enjoyed having a bit of a jam session with a couple of mates. They would probably wonder at the fuss and reverence accorded their "sessions" in the years to come. So it is with this album of Bill Evans and his trio: Bill Evans on piano, Scott LaFaro on bass and Paul Motian on drums.

This album was recorded live at the Village Vanguard, New York City, on Sunday, June 25, 1961. An avowed conservative, although jazz lovers may not regard him as such, Bill Evans and his trio were a practised group whose claim to memory is subtle rather than startling three-part improvisation.

Thirteen long tracks are featured on the four album sides: My Foolish Heart—My Romance—Some Other Time—Solar—Gloria's Step—My Man's Gone Now All Of You—Alice In Wonderland—Porgy—Milestones—Detour Ahead—Waltz For Debby—Jade Visions. (L.D.S.)

★ ★ ★

LITTLE PATTIE, Sunshine Of My Life ATA Records L 35292. Festival Release.

I don't know if the two photos on the sleeve of this record were taken sometime apart but the style would suggest on one hand the talented teenage star of a few years ago and the polished young lady of today. They serve to remind us of the fact that Little Pattie is an established part of the Australian music scene. Her performance on this record shows why she has remained so. The ten titles are: You Are The Sunshine Of My Life—Ben—Suddenly There's A Valley—The Night The Lights Went Out In Georgia—And I Love You So—The Morning After—If—Leave Me Alone—Without You—We're On Our Way—Since You're Not Around—Just Loving You.

The quality is very good. (N.J.M.)

★ ★ ★

A PIANO IN LOVE. The Tony Osborne Trio. Rediffusion GGS 1435 Stereo. Astor release.

If you would like a selection of piano 'standards' with love as the theme, this record is for you. Tony Osborne and his rhythm backing make a very enjoyable dozen with such titles as: And I Love You So—Love Is Blue—This Guy's In Love With You—I Wish You Love—From Tony With Love—Love Is A Many Splendoured Thing—Love Is Just Around The Corner—Warm And Wonderful Love—I Don't Know How To Love Him—April Love—Falling In Love With Love—When I Fall In Love.

From a musical point of view the record is a delight but the review copy was marred by a very persistent 'prickle' and crackle that could not be moved by the use of a 'Dust Bug'. (N.J.M.)

Books & Literature

Pirate radio

SHOESTRING PIRATES, by Adrian Blackburn, published by Hodder and Stoughton, Auckland, New Zealand, 194 pages and 70 illustrations.

The story of Radio Hauraki is one which changed the face of radio broadcasting in New Zealand, for nowhere else in the world did an off-shore pirate radio station receive such public support that the broadcasting laws were changed and monopoly broken and private broadcasting established. In the English Channel, Radio London, Radio Caroline and many more were on the air in the mid 1960's, and off Holland Radio Veronica operated for many years, but they were closed down due to Government intervention and radio regulations and accomplished nothing. But the dream of private radio in New Zealand became a reality thanks to Hauraki.

In this book Adrian Blackburn traces the story of the station from the first thoughts of David Gapes, a young Wellington journalist, who had the initial plan to break the monopoly in 1965. Subsequently the Tiri put to sea in the Hauraki Gulf after months of frustration and expenditure of money and energy, to become New Zealand's first and only pirate radio station. Many New Zealanders found this idea of private commercial radio an exciting prospect, and when Radio Hauraki began to broadcast the radio scene in this country began to change. Competition in radio was achieved, and so NZBC made major programme changes to combat this new competitor.

The book traces the whole story of Hauraki, the shoestring operation, the political opposition, its battle with the police court case, and the two shipwrecks which were the fate of Tiri 1 and then Tiri 2, and then the subsequent support which forced the Government to realise that private radio was here to stay and the setting up of the Broadcasting Authority which resulted in the licensing of the private stations we have today.

With excellent photo material showing the historic moments of the Hauraki story, it is indeed a book that every keen radio listener, and those interested in broadcasting, will want to read. Overseas the book should also have wide appeal, as nowhere has such a dream become reality. Free broadcasting organisations still exist in many countries, based on the hope of breaking a state monopoly, and many will perhaps take heart from the success of Radio Hauraki. And it took New Zealanders to show the world that it could be done! (A.T.C.)

Network theory

ILLUSTRATIONS IN APPLIED NETWORK THEORY, by F. E. Rogers. Published by Butterworth & Co, London, 1973. Hard covers, 140 x 220mm, 228pp, many diagrams. Price in Australia $14.00 hard covers, $7.00 limp.

A collection of worked examples in network theory, written primarily for the intermediate and senior student in electronics courses at university. As such it is not one of the familiar type, with simply a set of old final exam questions and their answers, but attempts to provide somewhat greater insight into both the principles involved, and their practical implications.

There are six chapters in all, headed as follows. 1 — General principles for passive and active network analysis; 2 — Transient response and its correlation with frequency response; 3 — Simplifying procedures, theorems and equivalences; 4 — Power transfer and allied concepts; 5 — Examples of non-linearity and the response of networks to non-sinusoidal waveforms; 6 — Electronic amplifiers with feedback circuits.

Each chapter begins with a general discussion of the topics involved in the examples, and each example is followed by a discussion of the particular points raised and their implications.

In short, a book which should be of considerable value to the tertiary level student, and perhaps also to the private student.

The review copy came from the local office of the publisher, who advises that the book should be available from all major bookstores. (J.R.)

How things work—2

HOW THINGS WORK, VOLUME 2. Published by Paladin, St Albans, Herts, 1974. Soft covers, 134 x 197mm, 591pp, many diagrams. Price $5.90 plus $1.25 post and packing (both volumes $11.50 plus $1.90 p and p).

A few months ago in these columns I reviewed the first volume of "How Things Work", and found it a most fascinating and valuable book. Apparently a lot of folk both here and overseas have reacted

in the same way, for the first volume has now sold almost a million copies! This must be a record, particularly for a book which is fundamentally a technical reference.

Now, as a result of this enormous success, the publishers have produced this second volume, which supplements rather than overlaps the first. And although the two are designed to go together to make an even more useful reference, either can stand by itself. They both deal with a wide range of technological topics, and the fact that they don't overlap testifies to the tremendous amount of technology in modern life.

In volume 2 there are all sorts of things, from mineshaft sinking to airfoils, from aerosol cans to multi-stage rockets, with topics like electroplating and torpedoes thrown in along the way. Of more specific interest to electrical and electronics buffs are items on nuclear reactors, colour TV, generators and alternators, communications satellites, electronic organs, slide rules, Ward-Leonard machines, waveguides, FM stereo broadcasting, time division multiplexing, and many more.

Like the first volume, the items are brief but basically quite sound, and the overall result is a book that is very difficult to put down if you've an ounce (gram?) of technical curiosity.

Excellent value for money, too.

The review copy came from Dick Smith Electronics Pty Ltd, of 160-162 Pacific Highway, Gore Hill, NSW 2065. (J.R.)

Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Contributors' mail

You have been kind enough to publish a few contributions of mine and they have resulted, not only in quite a number of letters from readers seeking additional information on these subjects, but also inquiries from others on quite unrelated matters. All of them have received prompt replies containing such help as I could give and I have been glad to give it.

However, I have been rather disconcerted by the casual manner in which such help is usually received, irrespective of the time and expense involved. My files show only one case enclosing stamps for a reply, and only one correspondent who troubled to send any acknowledgement, much less a word of thanks.

What is one to make of, for example, a professional man totally unknown, who telephones a query having no relation to anything published and involving a search for the desired information and, having received a letter representing some two hours of work, greets it with blank sanguinary silence!

What on earth has happened to our manners? Quite apart from the moral obligation on a man seeking help to reimburse his helper's out-of-pocket expense, surely common courtesy calls for, at least, one line on a postcard saying "Thank you for your letter" if only to indicate that the letter did reach its destination.

All the more honour to my two correspondents who did the right thing; I thanked them at the time for their courtesy and do so again. Their recognition that postage charges on today's absurd scale are not something to be shrugged off are truly appreciated.

Rather than give offence to any particular person, may I sign myself—

"MUGGINS"

COMMENT: The point you make is a very valid one. It is only common decency for those seeking help from a contributor to enclose a stamped addressed envelope for the reply. We would like to add, however, that contributors are under no obligation to answer queries from readers. Any assistance given by a contributor is entirely a matter of his or her discretion and opportunity, and should not be expected by readers as their right.

FM call-signs

Re the allocation of call-signs for the new Australian FM Broadcasting System may I suggest, possibly, a more efficient formula and the reasoning behind it.

I note with interest that some imported (European) FM receivers have allocated 'channels' to the FM band, which seem to allocate Channel 2 at about 87.5 MHz to Channel 70 at about 108 MHz.

The proposal to use the call-sign 2MBS/FM for the first allocation is both excessive and redundant. Excessive because of the six characters, and redundant because three (MBS) letters are not necessary, two will suffice as used with AM stations. In any case the letters MBS have represented Macquarie Broadcasting Service for many years. The letters "FM" are unnecessary if channel numbers are used just as "TV" would be unnecessary because channels are used in television. After all we say ABN-2 and TEN-10 and get the message very well with only four or five characters, i.e., the affiliation, the location (state) and the channel (to tune in).

I suggest a code based on channel numbers (very successful on TV), e.g., 2FC-12 would be the FM equivalent of 2FC even abbreviated to FC-12 and so on up to (say) 2SM-33! Reserving existing AM-band letters for those stations that already hold them, for the extension into FM.

May I summarize: Employ an existing (European ?) compatible channel configuration, allowing for minimum future spacing. Maximum of five characters incorporating channel numbers for simpler tuning and implying "FM-band station" channels.

R. A. Giuffre
North Bondi, NSW

COMMENT: The draft standards published by the ABCB for FM broadcasting do in fact divide the band into 100 channels, each 200kHz wide and numbered from 201 to 300. We imagine that the final system of call signs authorised may well be as you suggest, and not that being used by experimental licensees.

Centimetric heresy

As a reader of EA for more years than I care to remember, I'm appalled that a person with your education and background should defend the use of the centimetre. I have lived in many metric countries and as far as I can remember the centimetre is only used in the clothing industry!

I only hope the situation which so nearly happened with FM and colour TV does not happen with the centimetre. To say that it is a logical unit surely is a misuse of the word logic. I know some engine manufacturers use the term c.c., but so do the USA use cubic inches.

Surely the litre is logical. Thank goodness refrigeration people have some sense.

Otherwise compliments on a fine magazine.

Henry V. Oakes
Wagga Wagga, NSW.

COMMENT: Unfortunately your letter sheds no real light on the subject, only heat. As yet no one has been able to demonstrate that the centimetre is "illogical".

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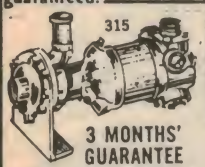

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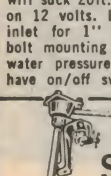

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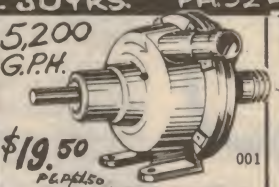

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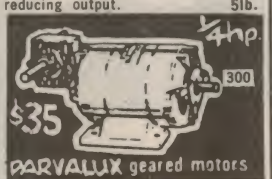
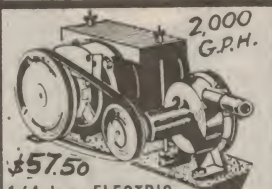
Top quality 1 1/4" inlet, 1" outlet (O.D.) corrosion proof all metal centrifugal pump. Capacity up to 5200 g.p.h., pressure up to 85 PSI. Has two heavy duty sealed precision ball bearings to give smooth running and long trouble-free life. Features newly designed, replaceable carbon and ceramic seal. Handles heaviest loads and highest speeds — designed to pass solids such as sand, silt, dirt, etc., without damage, will pump salt water without harmful effect. Heads to over 170', suction lift to 25'. Spare parts always available. Our very large production for export enables us to sell at this unbeatable price. Ball type foot valve for 1 1/4" hose $4.95, 12oz.
3" pulley to suit $1.95, 6oz.
This pump is also suitable for pressure spraying, use restrictor for reducing output. 5lb.



¼ h.p. beautifully made, originally for computers. Two speed with two ½ shafts. Fully ball bearing CAPACITATOR START. 1400 r.p.m. and thru gearbox 30 r.p.m. cont. duty. Size 12" x 5" complete with capacitators $35. P&P $3.50 cont. duty.
"Parvalux" England make some of the finest electric motors in the world and normally these would cost over $85 each to buy. These "Parvalux" ball bearing motors are ideal for large turntables, B-B-O soits, displays, etc.

ADD POSTAGE!!!



$57.50

1/4 h.p. ELECTRIC PUMP & MOTOR

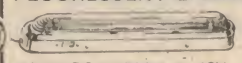
A superb unit consisting of 1/4 H.P. 240 volt AC electric motor, belt driving a quality 1 1/4" inlet, 1" outlet (O.D.), non-corrosive double ball bearing centrifugal pump. Gives 2,000 g.p.h., heads up to 40ft. Whole unit mounted on steel base, suction lift 15'. Ball type foot valve for 1 1/4" hose. $3.25. Rail Frt. On.

P&P $1.00 120

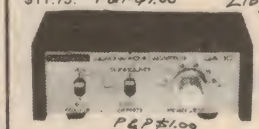
FAMOUS ENGLISH E.M.I. HI-FI SPEAKERS $11.50

13 1/2" x 8 1/2" complete with tweeter. Handles to 10 watts, 8 ohm impedence. 55-11,000 H.Z; Brand New in cartons, 1975 production 4lb.

TRANSISTORISED FLUORESCENT LIGHTS



12 volt DC model for any 12V battery with 7' of lead & switch. Size 14" x 2" x 2" with 12" tube. $11.75. P&P $1.00 2.1lb.

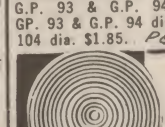


P&P $1.00

Special! 4 Channel QUAD ADAPTORS $24.50 118

First time in Australia. Converts your 2 channel stereo to 4 channel quadraphonic sound. Just add 2 speakers. Adjustable sound effect of rear speakers. Has effect suited for surround or concert hall. This is true quadraphonic sound. Max input 50 watts. 2 lb.

Famous English "ACOS" complete PICK-UP cartridges with STYLUS. Current issue to fit "Garrard" and most other types of players and decks from all countries. Complete with fixing screws and brackets. G.P. 101 hi output mono sapphire cartridge which will play stereo records. A special purchase. $1.95; G.P. 91-2 stereo sapphire. $2.50; G.P. 93-1 sapphire $3.50; G.P. 93-1 diamond. $4.50; G.P. 94-1 ceramic sapphire. $5.00; G.P. 94-1 ceramic diamond. $5.50. The latest from "ACOS", type 104 transcription P.Z.T. ceramic stereo cartridge for use with magnetic input. Buy from us and save — only $7.50. All above packed in individual cartons. P&P 25¢ 2oz.
Replacement STYLI available G.P. 91 sap. $1.20; G.P. 91 dia. $1.85; G.P. 93 & G.P. 94 sap. $1.25; GP. 93 & G.P. 94 dia. $1.85; G.P. 104 dia. $1.85. P&P 15¢



FRESNEL LENSES $4.50

265

12 In. sq. x 1 mm. thick. f.l. 13, 1/2 In.

Precision worked in thin optical plastic and providing large area magnification equivalent to expensive glass lenses. Fine optical quality permits use as solar furnace elements, condensers, image magnifiers, light intensifiers, overhead and back projection optics, camera image brighteners (disco scenes). Use our low RPM geared motors to drive these. P&P 25c 8oz.
Double Fresnel Lenses (condenser) same size as above $7.50 P&P 85¢ 1lb.

Circuit 24 "Meccano" Power Unit $9.50 P&P $1.25

Type 8156. This power unit was made by "Meccano", England for the Australian market. A special purchase enables us to sell at this low price. The unit is complete with two accelerators which are enclosed slider resistors with thumb control on slider for adjusting output voltages. Each has 3' of lead. Input is 240 volts AC, 50 c.p.s., two outputs are 26 volts AC at .63 amps and 26 volts AC at .63 amps or use together 26 volts AC at 1.3 amp. The unit can also be used as a 24 VOLT DC POWER SUPPLY with selenium rectifier extra $1.50. The unit on test for 24 hours gave 3 amps cent. without activating thermal relay. The unit is fully protected with inbuilt thermal relay. Housed in metal case with 6' lead and plug. Brand new in carton with instructions. Also used as 24v battery charger.

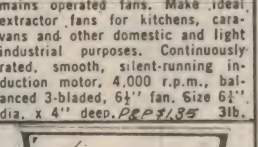
268

12 VOLT POWER UNITS, $6.50 P&P $1.25

Made in England by "Smoothflow", a division of "Meccano". 240 volt A.C. input, 12 volt D.C. output at .6 amp. Fully protected from damage by automatic cutout which resets itself automatically. Brand new in cartons with instructions. Ideal models, battery charger for small batteries (especially our Nife Batteries). Terrific bargain!

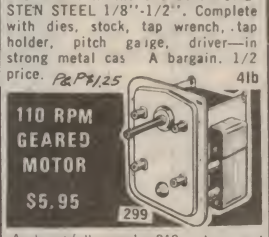
12 MONTHS GUARANTEE

Brand new English 240 volt A.C. mains operated fans. Make ideal extractor fans for kitchens, caravans and other domestic and light industrial purposes. Continuously rated, smooth, silent-running induction motor, 4,000 r.p.m., balanced 3-bladed, 6½" fan. Size 6½" dia. x 4" deep. P&P $1.35 3lb.



Brand New 40-Piece TAP & DIE SETS — $18.50

40-piece stock and dies covering the full range S.A.E. and WHIT. in the one box. TUNGSTEN STEEL 1/8"-1/2". Complete with dies, stock, tap wrench, tap holder, pitch gauge, driver—in strong metal case. A bargain. 1/2 price. P&P $1.25 4lb



A beautifully made 240 volt geared motor with tremendous torque. Molibdenum steel gears with approx. 20-1 reduction, continuous duty 4 threaded hole mounting, can operate in any position. BRAND NEW! Cost $14 to make. Rush this bargain 500 only P&P $1.00 2lb.

"Bodine" Geared Motors $15.50 P&P $1.75

Made in U.S.A. 240v AC, thermally protected, cont. duty with incorp. 19 to 1 gearbox. Final r.p.m. 71, has 3/8" x 1" shaft with removable sprocket, size 6" x 3½". 6lb.

"SMITH'S" TIME SWITCHES $3.50 P&P 50¢

Very accurate clockwork mechanism. Brand new 0-3½ minutes, 240 volt up to 15 amps. Ideal for photographic work etc. 8oz.

Special purchase! NICKEL CADMIUM BATTERIES $2.45

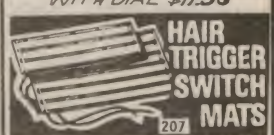
Almost everlasting. Can be left uncharged without harmful effect. 1.5 volts. 7 amp hour. Can be coupled together for any voltage. 11b 50¢ Small nickel cad. batteries, 1.5 volt, .4 AH. 95c each P&P 25¢ 3oz.

135

$9.50

G.P.O. Extension Telephones

P&P $2.00 Made to Post Office specifications. Complete with internal bell. Have your own extension phone in garage, under house, bedroom, office etc. SAME AS ABOVE WITH DIAL $11.50 9lb.



Wafer thin—undetectable under door mat or carpet. P&P 50¢
Operates by foot pressure over any part of surface.
Tough polythene envelope has sealed-in multi-strip contact ribbon that completes a circuit whenever anyone—even a small child—steps on to mat under which it is concealed. Ideal for burglar alarms, customer entry warning in shops, automatic door opening switch. MAX VOLTAGE 50V. MAX CURRENT 1 AMP. 144 CONTACTS PER SQ. FT.
Door mat—29in. x 16in. $5.95

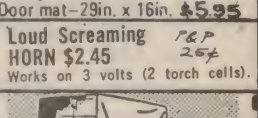
Loud Screaming HORN $2.45 P&P 25¢

Works on 3 volts (2 torch cells).

Fantastic Purchase

SAVE 60%

Woven & Laminated AUSTRALIAN POLY-FABRIC 061.



TARPAULINS

Woven & laminated Australian POLY-FABRIC. These tarpaulins are 100% waterproof, rot-proof, acidproof, superphosphate proof, will not shrink, impervious to oils and greases, etc., ultra-violet stabilized. Fully reinforced and eyeletted all round. Much stronger than 20oz. canvas. Super tough locknit POLY-FABRIC 20x20 cross weave laminated between two layers of vinyl. Completely untearable. Ideal for trucks, utilities, haystack covers, liners for dams, machinery covers, superphosphate covers, timber covers, hot houses, air ducting, etc. Extremely lightweight. These tarpaulins are being used by most large industries in Australia — mining companies, fertilizer manufacturers, machinery companies. Ideal for Boats: impervious to saltwater. Special sizes made to order. Write for quote.

6' x 6'	3lb	$7.45
6' x 8'	4lb	$8.95
10' x 8'	6lb	$13.75
12' x 10'	8lb	$19.85
15' x 12'	11lb	$28.75
18' x 12'	14lb	$32.75
20' x 12'	15lb	$37.50
24' x 12'	17lb	$45.50
20' x 15'	18lb	$47.25
24' x 18'	27lb	$66.25

New Products

Sony KV-1800AS colour receiver

Due for release this month is Sony's entrant in the colour TV receiver stakes, the KV-1800AS. A special "Australian market" design, the receiver uses full PAL-D decoding and complies with the ABCB and SAA standards. This together with its nominal 460mm (18-inch) Trinitron tube and other features should make it very popular.

The release of the Sony receiver has come a little later than most of the locally manufactured receivers, and even some of the other imported models. However this is no doubt due in part to the decision by Sony to produce a new design, based specifically on the Australian market requirements.

Despite the delay, the receiver is probably still going to be the first of the "small screen" sets on the local market, if we use this term to indicate receivers with screens of 460mm diagonal or less.

Thanks to the co-operation of Sony Kemtron Pty Ltd, we were able to have one of the advance models of the new receiver for a few days, just in time to allow us to publish our reaction in this issue.

Incidentally, the advance models came out ahead of the user and service manuals, so that we didn't have the benefit of these—either for testing or writing this report.

To begin with, the receiver is quite compact—measuring 600 x 420 x 500mm (W x H x D). It is also of quite modest weight—a pleasant contrast with many of the larger sets.

Probably the most obvious feature of the set is the Trinitron tube, of course, with its vertical phosphor stripes. With higher efficiency, the Trinitron gives the potential for very bright pictures. And from the sample set, the KV-1800AS receiver seems to make good use of this potential, giving a very good picture even in conditions of high ambient lighting.

The other advantage of vertical aperture tubes like the Trinitron is simpler and more reliable colour convergence. From the user's point of view, this is mainly evident in terms of a greater ability to move the set around, even while it is in operation.

We tried this, in fact, even taking it to extremes with the set facing the floor or the ceiling. Only in the latter position could we get a weak colour cast on a monochrome transmission—and this went away again as soon as we returned the set to the normal orientation. All of this was with the set on.

Sony claim that you can buy one of their sets, take it home and plunk it on the table, hook it up to an aerial and switch on to perfect pictures without any setting up. From this test, it certainly seems likely.

The receiver is fitted with a normal VHF turret tuner, covering all 13 of the local channels—so that those in areas with stations in channels 3, 4, 5 and 5A need have no fears. There is also a continuously tuned UHF tuner, ready for UHF transmissions if and when they start.

The Sony must in fact be one of the few colour sets so far released with a UHF tuner, even though the facility was recommended by the ABCB.

Sony Kemtron assure us that the KV-1800AS complies with all of the ABCB and SAA standards for colour TV receivers, so that it is fully standard in terms of mains transformer, IF channel, aerial input circuitry, full PAL-D decoder, and so on.

This is an important point, because full compatibility is unlikely to be provided by other Sony models bought overseas, or from unauthorised importers. Such sets may not be PAL-D, may not be able to receive all local channels, or may not have the recommended IF channel—apart from not having the full warranty offered by Sony Kemtron.

Incidentally, the KV-1800AS has a 12 month warranty on parts, a 24 month warranty on the picture tube, and a 6 month warranty on labour.

In our tests, both in the lab and in a typical home viewing situation, the KV-1800AS was very impressive. It gave bright, crisp colour pictures on all channels, with virtually no setting up required.

In short, if you're in the market for a 460mm set, it would be very hard to go past this one—particularly at the price of around $650. (J.R.)

Low cost multi-band VHF portable

Those who have a hankering to "listen in" on the VHF bands should find the Precor multi-band VHF portable of great interest. Dick Smith Electronics are currently offering it for a very attractive price.

Manufactured in Hong Kong, the Precor model 826 measures about 20 x 23 x 10cm, and weighs a little under 2kg. Its case is of the combined plastic/leatherette variety, provided with a plastic carrying strap.

The receiver provides for reception on four switched bands, although two of these are split apart in terms of dial markings—making it seem at first as if there are seven bands. The first is the normal AM broadcast band, 540-1600kHz; the other three then tune the VHF spectrum, covering 56–108MHz, 174–217MHz and 110–174MHz respectively.

The four bands are provided by four quite separate RF front ends, feeding a common IF and audio system. It may be noted, however, that while a normal diode detector is used for the AM band, a ratio detector FM demodulator is switched into circuit automatically for the three VHF bands. Thus the receiver is designed primarily for FM reception on the VHF bands, although it appears to function reasonably well on AM signals—perhaps due to the modest limiting.

Special features offered by the receiver include AFC, which may be switched in or out, and a tuning indicator circuit using an LED mounted in the centre of the dial pointer.

The receiver operates either from four "D" cells, or from the mains via an inbuilt power supply. It has an inbuilt ferrite rod aerial for AM and, a telescopic rod for the VHF bands. A 3mm jack is provided for earphone listening.

We tested the sample unit pictured, both in the lab and at staff members' homes, and it performed quite well. Sensitivity was quite good for this general class of receiver, and the other aspects of performance are quite adequate. Perhaps our only reaction is that we would have liked the VHF spectrum split into a few more bands, to make tuning a little less critical.

Still, this is being a bit academic. At the advertised price of $59, it is certainly excellent value for money, and just the shot for the would-be VHF listener.

Enquiries to Dick Smith Electronics Pty Ltd, 160-162 Pacific Hwy, Gore Hill 2065.

Navy buys Electrodata recorders

Electrodata Associates Pty Ltd have just delivered three of their new System 6400 instrumentation tape recorders (pictured) to the Department of Defence (Navy). The recorders were delivered to the RAN Research Laboratories at Rushcutters Bay in Sydney.

Of fully Australian manufacture, the System 6400 recorders include full input-output monitoring facilities on each channel of electronics; relay-less operation, in the interests of ruggedness and reliability; and automatic equalization of the record/play electronics over a 7-speed range from 1.2 to 76 cm/s. The last feature contrasts strongly with most imported instrumentation recorders, which require plug-in PCB replacement with speed changes.

These features together with the local design, manufacturing and service facilities offered by Electrodata doubtless played a part in having the machines selected by the Navy. It is expected that they will be used to record the results of oceanographic experiments at sea, and also for later analysis.

Enquiries regarding Electrodata instrumentation recorders should be directed to the company at 18 Coward Street, Mascot, NSW 2020.

NEW PRODUCTS

Freezer alarm

Gearing & Watson (Electronics) Ltd, UK, manufacturers of process control equipment, have released an alarm device which indicates both interruptions to the electricity supply and malfunctions in commercial freezers. The unit may be incorporated into freezers either at the point of manufacture or, alternatively, installed without the use of tools in freezers already in use.

There are two main reasons for failures in freezer units, the first being interruption to the power supply, often quite accidently. The new device provides immediate warnings of any power supply interruptions. The second reason for failure is a malfunction in the freezer itself, usually in the compressor unit or the thermostat. Should either of these devices break down, the unit is set such that it will sound the alarm when the temperature inside the freezer exceeds –15 deg C.

For further information contact British Merchandising Pty Ltd, Box 3456 GPO, Sydney, NSW 2001.

New range of greencaps from Philips

Recently released from Philips Elcoma is a new range of polyester capacitors. Rated at 100V, the new capacitors are available in values ranging from 0.0010uF to 0.47uF and should be readily available from most components stockists. Further information may be obtained from Elcoma Electronic Components and Materials, PO Box 50, Lane Cove, NSW 2066.

New circuit design & test product range

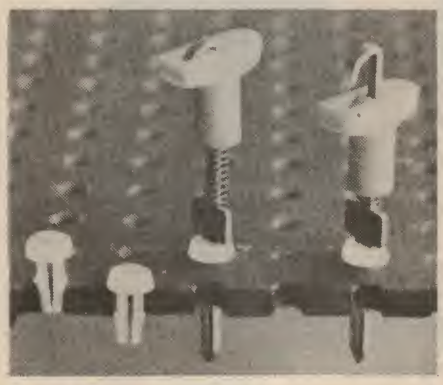
Three new products have recently been added to the E-Z-Hook (California) range of electronic circuit design and test products. Included are the E-Z X-M1 micro hook, the E-Z "nail" clips, and the PE-93 Perf-Eze board adaptors.

E-Z-Hook has added the X-M1 micro hook to its range of trouble shooter connectors. The new micro hook is just 4.3cm long, and is intended for work in cramped situations for hookups to wire wrapped pins and component leads. It takes its place alongside the existing E-Z X-M100W mini hook (5.7cm long) and the E-Z XL-5 mini hook (12.7 cm long) test aids, and is available in any of the 10 standard RETMA colours.

In company with its bigger brothers, the new X-M1 micro-hooks feature rugged

construction, with beryllium copper contacts, stainless steel springs, and durable nylon bodies. All units are designed to give maximum holding power, true readings through a single contact point, and maximum insulation protection in a minimum of space.

The new E-Z-Hook nailclips come in three hook sizes, and are also available in the 10 standard RETMA colours. The range includes: No 81-1 E-Z-Hook "nail" clip (standard); No 81-4 for No 14 wire; No 83-8 for multiple wires; and the No 84-HT, an all metal clip for high temperature uses. These are offered separately, or as a complete kit, the K8150T, consisting



of 50 clips, the T-20 driving tool and instructions.

The clips may either be driven into wood (like a nail) using the T-20 tool, or may be pressed into .0933in matrix board using the PE-93 Perf-Eze nylon inserts. The nail ends of the clips are cadmium plated, allowing solderability below board for connection of test systems. Applications include breadboarding and pre-testing circuits, and laying out wiring harnesses.

For further information, contact General Electronic Services, 99 Alexander St, Crows Nest, NSW 2065.

Ad magnifier from Dick Smith

We have just been advised by Dick Smith that the print size in his February newsletter is to be the same as that used in his now famous ads which appear monthly in this magazine. Dick chooses the small type face for a reason of course: to cram as much information as possible into the available space to keep you lot informed; although its a bit rough on the eyes!

However, Dick has found the answer, and now has available stocks of magnifying glasses to enable those with ailing eyesight to read his ads. The magnifying glasses are priced at a modest 95c each and, according to Dick, only enlarge the type—the prices stay the same.

Available from Dick Smith Wholesale Pty Ltd, 160-162 Pacific Highway, Gore Hill, NSW 2065.

PHILIPS LOUDSPEAKERS

AD 0160/T8 1" Dome Tweeter ...	$8.00
AD 5060/Sq8 5" Squawker	$12.50
AD 8065/W8 8" Woofer	$12.00
AD 10100/W8 10" Woofer	$33.00
AD 1265/W8 12" 30 watt Woofer	$24.00
AD 12100/W8 12" 40 watt Woofer	$35.00
2 way Crossovers	$6.50
3 way Crossovers	$12.50

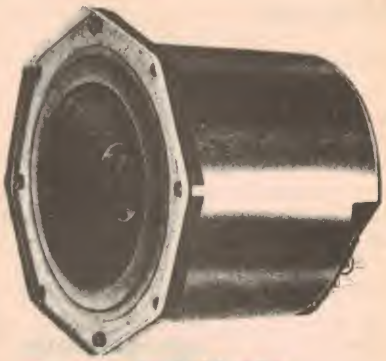
PHILIPS KIT NO. 1
2-AD 8065/W8
2-AD 5060/Sq8
2-AD 0160/T8
2-3 way Crossovers
TOTAL PRICE $82.00

PHILIPS KIT NO. 2
2-AD 10100/W8
2-AD 5060/Sq8
2-AD 0160/T8
2-3 way Crossovers
TOTAL PRICE $122.00

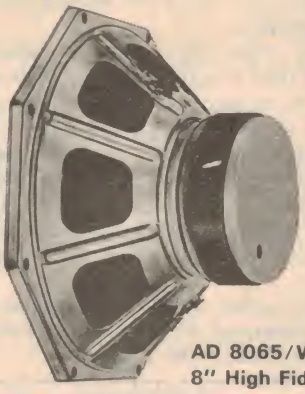
PHILIPS KIT NO. 3
2-AD 1265/W8
2-AD 5060/Sq8
2-AD 0160/T8
2-3 way Crossovers
TOTAL PRICE $99.00

PHILIPS KIT NO. 4
2-AD 12100/W8
2-AD 5060/Sq8
2-AD 0160/T8
2-3 way Crossovers
TOTAL PRICE $120.00

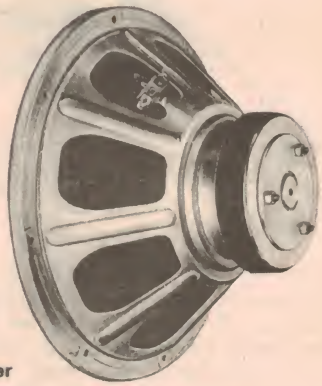
AD 0160/T8
1" High Fidelity Dome Tweeter



AD 5060/SQ8
5" High Fidelity Mid Range



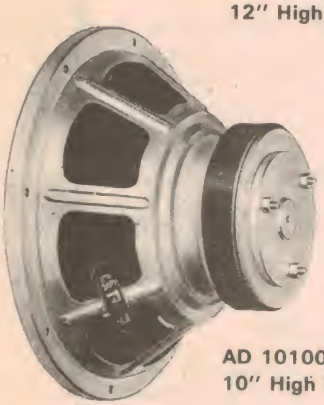
AD 8065/W8
8" High Fidelity Woofer



AD 12100/W8
12" High Fidelity Woofer

CORAL 12" SPEAKER KIT 12SA1
2-12" 30 watt RMS Woofers
2-5" sealed back squawkers
4-1" Tweeters
Crossovers etc.

FULL PRICE $70.00



AD 10100/W8
10" High Fidelity Woofer

CORAL 10" SPEAKER KIT 10SA1
2-10" 25 watt RMS Woofers
2-5" sealed back squawkers
2-1" Tweeters
Crossovers etc.

FULL PRICE $50.00

CORAL 8" SPEAKER KIT 8SA1
2-8" 15 watt RMS Woofers
2-4" Midrange speakers
2-1" Tweeters
Crossovers etc.

FULL PRICE $30.00

BOXES FOR 12SA1 $35.00 each
BOXES FOR 10SA1 AND 8SA1 $30.00 each

WE ALSO STOCK INNERBOND AT $1.80 PER SQ. YD.
SPEAKER CLOTH (for front of box)
60" by 36" $12.00

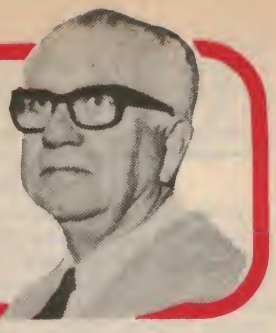
PHONE: 747 2931

Edge Electrix

34A BURWOOD RD., BURWOOD 2134

The Amateur Bands

by Pierce Healy, VK2APQ



"Ham"—term of affection or disdain?

The derivation of words, the origin of names, terminology, abbreviations or catchwords, can be an interesting subject. Amateur radio is not without its own vague assortment.

As time passes the origin of many sayings or terms are forgotten or corrupted. Often they are given an entirely different meaning to that originally intended. Amateur radio is not without its share of idioms. Some are not understood or, to say the least, used misleadingly. Particularly by those with only a superficial contact with amateur radio.

Of these the word "ham" is the most common, particularly when used in the daily news media.

In an effort to throw a little light on some of these foibles, and to answer some of the enquiries received, the following explanations are offered. While no claim is made that any of them will be found in Encyclopedia Britannica, they may provide some interesting points for consideration and debate. Also, enlightenment to those whose writings or utterances indicate ignorance about amateur radio or the activities they associate with it.

First a look at the basic definition. The "Amateur Radio Service" was formally recognised internationally at the International Telecommunications Union conference in Washington, D.C., in 1927.

Chapter 1, Article 1, No. 78, ITU Radio Regulations, Geneva, 1959, defines the amateur service as—

"A service of self-training, intercommunication, and technical investigations carried on by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest".

The implementation of the ITU mandate, plus the standard of technical qualifications required to operate an amateur station, are left to the administrations of individual countries.

The name "ham" has no official standing. On the contrary, in 1959 the federal council of the Wireless Institute of Australia adopted a policy that the use of the term "ham" be discouraged, particularly when referring to amateur operators or in representations being made to top administrations.

To the majority of amateurs all over the world the term "ham" has an affectionate quality. One which indicates a kind of kinship which knows no national boundaries, colour or creed.

Unfortunately, it is often used in a derogatory manner by persons with very little knowledge of amateur radio. They use it to describe anyone operating a radio transmitter which is not licensed as a commercial service.

In its correct context, the term "ham" when applied to those who communicate using radio equipment, should apply only to those persons who are legally licensed by appropriate national administrations. The term should never be used by the news media to describe a person who is not licensed to operate a radio transmitter within the ITU definition of the amateur service.

The users of so-called "citizen's band" equipment, whether holders of permits or not, do not come within the ITU amateur service definition.

What is the origin of the term "ham"? Here are three versions, each going back to the days when Morse code was the exclusive means of radio communication. Of these the third, because there is no derogatory implications or connotations, seems to be the most logical.

1. A corruption of the word amateur used by commercial operators when refering to operators of amateur stations.
2. From the expression "ham fisted" meaning heavy handed, or inability to handle a telegraph key in a proper manner.
3. From the abbreviations used to attract the attention of members of the Hampshire Radio Club, reputed to be one of the largest and most influential radio clubs in the USA: ie, "CQ HAMS", sent in Morse code as a general call to all members of the club.

LOCAL AND OVERSEAS NEWS

IARU REGION III ASSOCIATION

The third and what should be considered a crucial meeting of the International Amateur Radio Union, Region III Association, is planned to commence in Hong Kong on 4th March, 1975. The Hong Kong Amateur Radio Transmitting Society (HARTS) will be acting as hosts.

The inaugural meeting, initiated by the WIA, was held in Sydney at Easter 1968. The second meeting took place in Tokyo at the invitation of the Japan Amateur Radio League in March, 1971.

There are nine national amateur associations at present members of the IARU Region III Association. The most recent society to be admitted is the Singapore Amateur Radio Transmitting Society (SARTS).

An aim of the association is to actively represent the amateur service in Japan, South East Asia, India, the Philippines, Australia, New Zealand and Oceania, through the IARU at international conferences, as well as on any matters that may require liaison with administrative bodies within the area.

Although exact details have not been made known, it is certain that very definite proposals will be put forward to ensure that national amateur societies fully realise their responsibility for the future of amateur radio. In particular, to ensure that the amateur's point of view has been adequately presented to their respective government administrations. Something which would appear to be essential is to establish early liaison with administrative bodies, prior to their establishing agenda policies for ITU World Administrative Radio Conferences. The next WARC is to be held in 1979.

Steps may also be taken to ensure that the Region III Association is not allowed to again go through a period of inactivity, due to the inability of persons to carry out tasks they accepted as voluntary officers.

It is expected that representatives of the member societies will confer with members of their various organisations so that the widest cross-section of opinions and suggestions from Region III amateurs will be available for consideration at the Hong Kong conference.

All amateurs in the Region should take particular interest in the activities of the association.

WIA YOUTH RADIO SCHEME

Increased postage and other administrative costs have made it necessary for the YRCS registration fee to be increased to $3.00 per year in NSW. The decision to raise the fee was reluctantly decided upon at the December meeting of the NSW YRCS management committee. The committee also co-opted Mr. Robert Lloyd Jones, club leader of the Crestwood club as publicity and public relations officer and Mr George Darouti, organiser St George Training Annexe to re-introduce a system of incentive packets for successful YRCS students.

The new constitution for the YRCS organisation in NSW has been completed in final draft form and has been submitted to the NSW divisional council, WIA for ratification.

The committee also expressed appreciation to Dick Smith Electronics Ltd. for the donation of two radio reference books to be awarded as prizes to successful candidates at YRCS examinations. One has been made available to CAMTEC for presentation to the most successful student in their vacation course. The other to be awarded on the recommendation of the educational officer, Mr Ken Hargreaves.

RADIO CLUB NEWS

Gold Coast Radio Club

The Gold Coast Radio Club net is conducted every Sunday evening at 0930GMT on Channel 1 FM repeater and on 3650KHz at 1000GMT using SSB. The club station VK4WIG is the net control on both frequencies. Individuals and other clubs are invited to join the 80 metre net.

The GCRC repeater VK4WIG/R1 is giving good service. The longest distance contact to date has been 250 kilometres to Bundaberg. Work is expected to commence shortly on the repeater aerial system and mast, following receipt of the insurance claim covering the damage caused by a recent mishap.

Central Coast Amateur Radio Club

A final reminder. The annual field day of the Central Coast Amateur Radio Club will be held at the Gosford Showground on Sunday, 23rd February, 1975. See last month's notes for program details.

An application has been submitted to the Lands Department to obtain a site for the re-location of the central coast repeater. The deviation out of the repeater transmitter has been reduced to + or − 10KHz peak to accommodate the narrow band units now available. For input signals greater than + or − 10KHz deviation compression will occur.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR BANDS

Illawarra Branch

Lyle Patison, VK2ALU moonbounce project co-ordinator for the Illawarra Branch presented a talk on amateur radio to the Port Kembla Rotary Club on 21st November, 1974. It is understood that the evening was most successful. Members of the branch are grateful to Lyle for the promotion of amateur radio in the area.

Moorabin & District Radio Club

The December issue of the Moorabbin and District Radio Club publication "APC" contains the annual report for 1974. The club, which was founded in 1948, is in a healthy financial position. During the year the club took an active part in the Jamboree-on-the-Air, the WIA national field day, and provided an attractive display for the Moorabbin Youth Expo at the Moorabbin Town Hall.

It also gave details of general activities of the club. It was pointed out that lack of funds had prevented the Moorabbin council from proceeding with construction of club rooms for the use of several clubs in the area. However, it is anticipated that construction will commence early in 1975.

At the annual meeting, David Rosenfield, VK3ADM, was re-elected as president. Jim Keenes and Ed Manifold were awarded honorary life membership of the club in recognition of their long association and service to the club from its beginning 26 years ago.

An honorary membership certificate will be awarded to any non-member who make the required number of two-way contacts with club members.

For DX stations—five contacts are required.

For other stations—fourteen contacts are required.

Applications with all relevant information should be made to the Certificate Officer, P.O. Box 88, East Bentleigh, 3165, and if approved a handsome certificate will be issued.

DARWIN DISASTER

As we go to press, word is filtering through as to the part amateurs are playing in providing vital communications with cyclone devastated Darwin. One of the first amateur links to be established was from a mobile unit in a car 13km outside Darwin. Gary, VK2BNN, his wife Wendy, VK2BYL, and "Slim" VK8JT made contact with Victorian amateurs about three hours after the cyclone struck. They provided one of the few links with police and emergency authorities.

On Boxing day and the days following, an emergency SSB phone net was established on 14.111MHz with VK3AUP in Melbourne as the control station. They worked in conjunction with the Victorian police disaster centre, handling urgent traffic concerning transport, supplies, evacuees etc.

There were several amateur operators at the Darwin end, whose identity is unknown at the moment. "Slim", VK8JT is the only one identified, but VK8CW, at Alice Springs, operated as a relay station when required.

By the 27th December the net had grown to a nation wide system, involving stations in Cairns, Townsville, Rockhampton, Mackay, Mt Isa, Brisbane, Lismore, Armidale, Sydney, Canberra, Cooma, Melbourne, Adelaide, Perth and Alice Springs.

Two other Northern Territory amateurs, VK8KK and VK8MO planned to fly into Darwin on the 27th taking an FT75 and an FT101, plus spares, to back up existing systems.

We hope to give a detailed story in next month's notes.

Westlakes Radio Club

All classes at YRCS level will be resumed at the Westlakes Radio Club on Saturday 8th February, 1975. Now that the club has settled into its own premises in York Street, Teralba, plans are being made to put the club motto "Progress through Activity" into top gear in the field of lectures and practical instruction.

Two young members who have played a prominent role in the YRCS lecture area of the club will be entering new roles in 1975. Jamie Campbell, VK2YCJ will be attending the PMG's Department training school in Sydney and David Crofts, VK2YBR will be going to the university in Canberra to study forestry for four years.

Maitland Radio Club

The Maitland Radio Club Theatrette was filled to capacity for last of the year's activities. This was a Christmas party and variety concert. The entertainment was provided by club members together with local and visiting artists.

Several members have commenced construction of special projects for display at the 1975 Maitland Show. Prizes are awarded in three sections, elementary, junior and general.

The club re-opened for YRCS classes and general activities on Friday, 31st January, 1975.

CHC Chapter 66

Alex Slight, VK2ZA, president of Chapter 66 of the Certificate Hunters Club reports some interesting news about the "ACE" awards inaugurated by this Australian chapter in August, 1973.

To date four "ACE 125" awards have been issued, the recipents being—VK2CX; VK2ZA; VK4LZ and short-wave listener Charles Thorpe, of Rockhampton, Queensland.

Forty "ACE" awards have been issued, of these thirteen have been won by New Zealand

stations. The first of these awards was made to ZL2AH.

Membership grading is based on a points score system. Full and limited licensed amateurs as well as short-wave listeners are invited to seek details of the points system from Alex Slight, VK2ZA, 31 Lamrock Street, Bondi Beach 2026, or Jack Gutcher, 17 Foulds Court, Montrose 3765.

John Moyle Memorial Field Day Contest

Amateurs and short-wave listeners are invited to participate in the 1975, John Moyle Memorial National Field Day, sponsored by the WIA.

Contestants may participate either as individuals or as part of a group. There are two divisions in this contest. The first one is for 24 hours continuous operation and the second for any continuous period of six hours. Either period must be within the 26 hours available.

CONTEST PERIOD

From 0600 GMT, Feb. 8th, 1975 to 0800 GMT, Feb. 9th, 1975.

OBJECTS

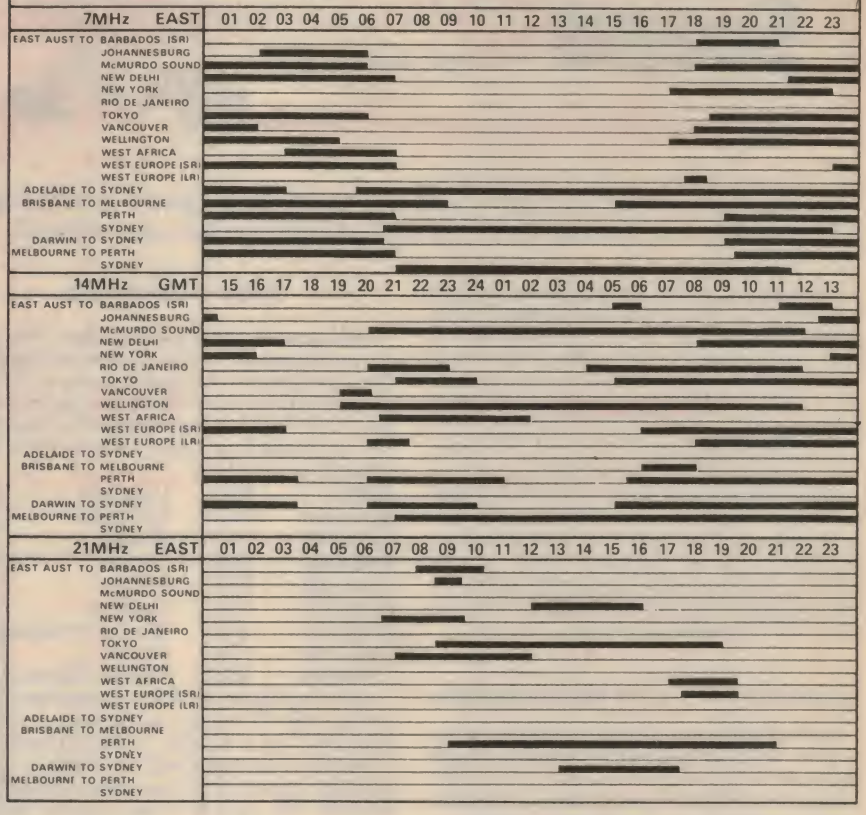
The operators of portable field stations or mobile stations within the VK call areas will endeavour to contact other portable, mobile or fixed stations in VK, ZL and foreign call areas on all bands.

RULES

1. In each Division there are 8 sections.
   (a) Portable field station, transmitting phone.
   (b) Portable field station, transmitting CW.
   (c) Portable field station, transmitting open.
   (d) Portable field station, transmitting, phone, multiple operation.
   (e) Portable field station, transmitting, open, multiple operation.
   (f) VHF portable field station or mobile station, transmitting.
   (g) "Home" transmitting stations.
   (h) Receiving portable and mobile stations.
2. In each division, 24 or 6 hour, the operating period must be continuous.
3. Contestants must operate within the terms of their licence.
4. A portable field station must operate from a power supply which is independent of a vehicle or permanent installation.
5. No apparatus may be set up on site more than 24 hours before the contest.
6. All amateur bands may be used but cross band operation is not permitted.
7. Cross mode is permitted but note rule 21.
8. All operators of a multi operator station must be located within approximately an 800 metre diameter circle.
9. Each multi op transmitter should maintain a separate log.
10. All multi op logs should be submitted under one call sign.
11. Only one multi op transmitter may operate on a band at a time.
12. RS or RST reports should be followed by serial numbers beginning at 001 etc.
13. SCORING FOR PORTABLE FIELD STATIONS AND MOBILES.
    Portable field stations and mobiles, outside entrants call area—15 points.
    Portable field stations and mobiles within entrants call area—10 points.
    Home stations outside entrants call area—5 points.
    Home stations within the entrants call area—2 points.
14. SCORING FOR "HOME" STATIONS.
    Portable field stations outside entrants call area—15 points.
    Portable field stations within entrants call area—10 points.
15. Portable field stations may contact any other portable field station twice on each band (10-160) during the period of the contest provided that four hours elapse after the previous contact with that station on that band.
16. VHF portable-mobile field stations may contact any other VHF portable-mobile field station repeatedly provided that two hours elapse after the previous contact on that band.
17. Operation via active repeaters or translators is not acceptable for scoring.
18. All logs shall be set out under headings of date-time in GMT, band, emission, callsign, RST sent, RST received and points claimed. List contacts in correct sequence. There **must** be a front sheet to show . . . name, address, division, section, call sign, call signs of other operators, location, points claimed, equipment used and power supply. You must also certify that you have operated in accordance with the rules and spirit of the contest.
19. Certificates will be awarded to the highest scorer of each section of the 6 hour and 24 hour divisions. The 6 hour certificate cannot be won by the 24 hour entrants. Additional certificates will be awarded for excellent performance.
20. Entrants in sections a, b, c, d, e and f must state how power for transmitting is derived.
21. All CW-CW contacts count double. Cross mode contacts do not count double.
22. Entries must be forwarded in time to reach the Contest Manager by 21st March, 1975. The address is Federal Contest Manager, Box 67, East Melbourne 3002.

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 2.75



RECEIVING SECTION

This section is open to all short-wave listeners in VK call areas. Rules are as for transmitting stations but logs do not have to show report and serial number of the second station or station called. Logs must show the call sign of the portable or mobile station heard, the report and serial number sent by that station, and the call sign of the station called. Scoring is as shown in rule 14 for home stations. A station calling CQ does not count. Portable-mobile stations, which must be listed in the left hand call sign column of your log, alone count for scoring. Stations in the right hand column may be any station contacted. A certificate will be awarded to the highest scorer of each of the 6 hour and 24 hour divisions, individual or multi operator entries. Certificates will be issued for excellent **performance.**

Shortwave Scene

by Arthur Cushen, MBE

This year, the 11 year sunspot cycle will reach its low point, and readers will continue to find reception on higher frequencies very difficult.

During the past few months, listeners will be well aware of periods of erratic reception when interference has been severe, and many of our favourite stations have been difficult to receive. The 11 year sunspot cycle is now almost at its lowest point which means shortwave stations are using the lower frequencies from the 49 to 25 metre band, and little activity of a DX nature is heard on the higher frequencies.

Some readers have been concerned that their receiver is falling off in its performance. However, this is not the case as it is the disturbed conditions that are the cause of its poor efficiency. We hope that by this time next year there will be a rapid rise in sunspot count and more stable reception conditions.

LEBANON HAS NEW FREQUENCIES

Radio Lebanon at Beirut has been heard on two new frequencies in its transmission to North and South America. The broadcast at 2300GMT through to 0100GMT is on 9570kHz, and causes severe interference to the BBC Far Eastern Service in Malaysia, which is carrying the World Service at this time.

The other new frequency is 9525kHz, and this gives better reception with an English program from 0230-0300GMT. The signal suffers from slight jamming, but there is no direct interference to the broadcast. This transmission actually opens at 0130GMT in French, with Arabic at 0200GMT and English at 0230GMT.

ISRAEL'S ENGLISH SERVICE

According to a schedule received and published in the Australian DX News, the Israeli shortwave station is now broadcasting one hour later due to the resumption of 'normal' as opposed to daylight saving time. Their English language schedule is as follows:

GMT	kHz
0500-0515	6000, 7395, 9009, 9695 and 12025 with short news bulletin.
1130-1200	9009, 12025, 15100, 15130, and 17690 with news and newsreel.
2000-2055	7395, 9009, 9495, 9630, 9815, 11645, 12025, 15100, and 17690 with news and newsreel.

The English news broadcasts at 2000GMT have been well received by P. Jenkins, Hawthorne, Victoria, on 12025kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summer time, 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

KGEI SCHEDULE

The Gospel Station KGEI in San Francisco has issued a tentative schedule due to come into effect on March 2. According to this schedule, the 250kW transmitter will be used for the Asian area, while programs on the 50kW transmitter will be beamed to Latin America. The new schedule is as follows:

GMT	kHz	Language
2130-0330	15355	Portuguese
0330-0700	11955	Spanish
0700-0900	9520	English
0900-1100	5980	Russian
1100-1200	5980	Japanese
1200-1400	5980	Chinese (Mandarin)
1400-1500	5980	English
1500-1700	9520	Chinese (Mandarin)

The schedule for the 50kW transmitter which carries only broadcasts in Spanish is: 1430-2130GMT on 15175kHz; 2130-0300GMT on 15280kHz; 0300-1000GMT on 9615kHz; 1000-1230GMT on 6000kHz and 1230-1430GMT on 9615kHz. The address of the station is: KGEI, Redwood City, California 94063.

RADIO NORTE ON 4807kHz

Another Dominican station, previously only operated on medium-wave, has commenced a shortwave service. The new station is Radio Norte at Santiago, formerly operated on 720kHz, and now heard on 4807kHz around 0700GMT. According to the station announcement they are broadcasting 24 hours a day.

Signals in New Zealand are fair, but not as strong as those from Radio Popular in Ecuador on 4800kHz. The address of Radio Norte is Calle Pedro Fco, Bono 58, Santiago. The station was first observed by Steven Greenyer of Invercargill and Chris Davis of Featherston.

BBC WORLD RADIO CLUB

The BBC World Radio Club program has recently been retimed and is now broadcast on Wednesday at 1330 and 2315GMT, on Friday at 2030GMT and on Sunday at 0815GMT.

The session is one of the most popular with shortwave listeners. In addition to DX Tips from the monitoring services it includes interesting news on the development of broadcasting in the United Kingdom. The session is produced by Reg Kennedy, assisted by Henry Hatch.

The BBC World Radio Club has over 15,000 members and membership is free on application to the BBC World Radio Club, Bush House, London WC2B.

The best reception in this area is on Sundays at 0815GMT when three frequencies give good reception. These are 7150, 9640 and 11955kHz.

NEW TUNISIAN STATIONS

Two high-powered transmitters are to be installed this year in Tunisia, according to Sweden Calling DX-ers. It is reported that Radiodiffusion Television Tunisienne bought the new transmitters from the German manufacturer Telefunken. One of these, a SW transmitter of 600kW output, will be installed at Sfax in the south of Tunisia and programs will be beamed to the Middle East. The other, a MW transmitter of 350kW, will be installed at Gafsa in the south-west of Tunisia, and will transmit Arabic programs to North Africa. The new transmitters will begin operation around October 1975.

MEDIUM-WAVE NEWS

NEW ZEALAND: Station 4YQ at Queenstown is now operating on 1120kHz with 100W. The power will be increased to 2kW later this year when a new transmitter is installed. The present schedule is from 1800-0800GMT. Programs are relayed to 4YQ from the NZBC Dunedin stations 4YA and 4ZB, and consequently consist of both commercial and non-commercial programming.

SAUDI ARABIA: According to Medium-Wave News, Saudi Arabia plans to install six new 1000kW transmitters. Four of these will be located at Duba on the Red Sea Coast, and will operate on 548 and 1520kHz. The other two will be located at Qurayat and will operate on 611kHz. Two 500kW transmitters operating on 899kHz are also planned for Qurayat.

LISTENING BRIEFS
EUROPE

HOLLAND: Radio Nederland has made a frequency change in its broadcast in English which is heard from 0930-1050GMT. The new channel is 15110kHz which replaces 9640kHz. At the same time, the broadcast is available on 11825kHz. The reason for the frequency change is because of the severe interference on 9640kHz from the Voice of Korea.

POLAND: Broadcasts from Warsaw in English are providing good reception on 9675kHz from 0630 to 0700GMT. According to Alex Wellner, Sydney, NSW, signals have been good in his location during this transmission.

ROUMANIA: Radio Bucharest has additional English transmissions to Australia and New Zealand according to the World Bulletin. These are at 1200-1225GMT and 1500GMT. The broadcast at 1200GMT is on 17840 and 15240kHz, and the broadcast at 1500GMT is on 15250, 11940 and 9570kHz.

FINLAND: Helsinki advises of a frequency change in their service to North America. The transmission to North America at 0300-0400GMT (0300-0330GMT in English, 0330-0400GMT in Finnish) is now broadcast on 9720kHz in place of 9550kHz.

AMERICAS

VENEZUELA: The BBC Monitoring Service reports that Radio Nacional de Venezuela at Caracas is operating an external service to Europe and North and South America. The service is transmitted on 15390 and 11750kHz according to the following schedule: 2200-2300GMT in English; 2300-2400GMT in Spanish; 2400-0100 in English.

BRAZIL: Radio Nacional at Brazilia is using the new frequency of 9605kHz for its English transmission from 2100-2200GMT. The station has retained the old frequency of 11780kHz for its program in Portuguese from 1900-2000GMT and for its German program from 2000-2100GMT.

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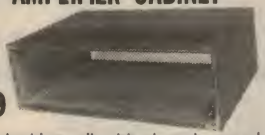

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RCA de-luxe R / B	25c 25c
2.5mm earphone	15c 15c
3.5mm earphone	20c 20c
6.5mm mono phono	45c 30c
6.5mm mono de-luxe	55c 40c
6.5mm stereo phono	60c 55c
6.5mm stereo de-luxe	75c 75c
2 pin mains	30c 25c
4mm instrument R / B	18c 20c
10 up, less 10%	50 up less 20%

MICRO MINIATURE Plessey 3 pin plug socket set

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Model ST-8S — 40 Watt max, 8 ohms, size 86mm diam x 38mm deep, output level 92dB **$37.90** ea

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SUIT HOMODYNE, HOBBYISTS, SERVICEMEN

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MODEL PRT6 — Manual type, 3 coils:— aerial, R.F. amp and oscillator. Compact size only 2½" x 1¼" x 1¼" with 1¾" shaft. Made by MSP, comes complete with knob and connection diagrams. **$1.95.**

MODEL PRT9 — Manual type 4 coils. Same as push-button type but with tuning spindle and dial pointer. With connection diagrams. Stock No. 044-043. **$1.50.**

MODEL PRT10 — Manual type 3 coils. Same as push-button but with tuning spindle and dial pointer, connection diagrams. Stock No. 037. **$1.50**

MODEL PRT15 — Push-button / manual type, 4 coils. A high-grade tuner with long-life mechanism and resettable push-buttons. Comes complete with dial pointer, push-knobs, tuning spindle and knob and connection diagrams. Stock No. 029-047-052. **$2.90.**

MODEL PRT18 — Jap push-button / manual, 3 coils, complete with push-knobs, tuning spindle, dial etc. R-2900 **$3.20**

MODEL PRT19 — Jap push-button / manual, 4 coils C / W dial etc as above, suit most Jap radios etc. R-2890 **$3.50**

MODEL PRT-20 — Jap push-button / manual, 4 coils, as PRT19 but with left hand tuning spindle SK338 **$3.50**

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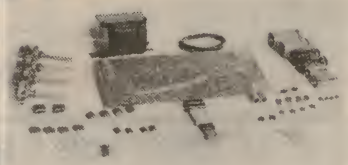

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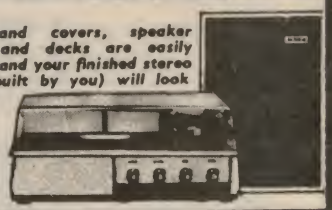
Amazing offer for "hi-fi-ers" — Stereo amplifier kit, giving 15W RMS in 4 ohms, 10W rms in 8 ohms (per channel) with 5mV magnetic cartridge input. VOLUME, BALANCE, BASS and TREBLE controls supplied — latest integrated circuit pre-amp and driver stages, complementary "flat-pack" output transistors — all on one P.C. Board for easy assembly. Hi-Fi performance with 20Hz to 50KHz response, low distortion and low hum level ensure compatibility with the best turntables and speakers.

A great new "Do-it-Yourself" project

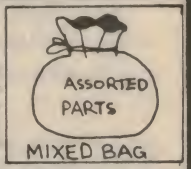
Plinths and covers, speaker cabinets and decks are easily available and your finished stereo system (built by you) will look like this.



BONANZA JACKPOT!

$25 value for only $5

For experimenters and constructors. a large assortment of new, highest quality electronic components — samples, specials, end-of-line components incl semiconductors etc. This is real anti-inflationary VALUE FOR YOUR MONEY!



ENGLISH CERAMIC MICROPHONES

New Acos ceramic microphone — a sensitive hands-held microphone for tape recorders and G.P. experimenting. Frequency response 100Hz to 8kHz with crystal clear sound. Features retractable desk or table stand.

A few only available. **$1.99 ea.**

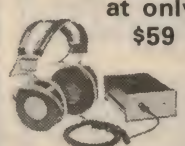
LATEST Transistorised TV CAMERA Scoop!

Ideal for closed-circuit television, amateur TV transmission, video recording etc. Operates direct into any standard TV receiver, mains powered, features ¾" vidicon for bright, sharp image. This well-known Japanese import is normally priced at around **$299.** — only 20 available so be early.

Full Price **$179**

ALPHA ELECTRET STEREO HEADPHONES

at only **$59**



A great New Year SPECIAL

Finest sound quality attainable from these ultra-light weight headphones. Extremely low distortion and near-perfect reproduction are now possible. Comes complete with converter and attaches to speaker terminals. Suits 4-16 ohms, 16Hz-22KHz response, 100dB sensitivity, 3 metre lead. Well worth the money.

NOW OPEN

115 117 PARRAMATTA RD
(CNR LLOYD GEORGE AVE)
CONCORD SOUTH NSW
Ph 747 6472

TRADING HOURS 12 Noon 6 PM Fri 8.30 1 PM Sat

BULK STORE AND WAREHOUSE

NOTE: Add postage, rated 10% of order value. Minimum order value = $2.00. C.O.D.'s send $2.00 prepayment. Guaranteed 24 hrs despatch or money refunded. Please use this easy order form. Any excess refunded.

INFORMATION CENTRE

CONVERTING TV SET: My compliments on a fine and interesting magazine which has and will play a significant part in my technical education. I have a TV set that I would like to convert to an oscilloscope. I have been told that there was some information on this in your magazine around 1963. Could you please tell me the month of this magazine and also if there has been any other relevant material printed in Electronics Australia. Keep up the good work and thank you. (Carl, Ron and Tony, Croydon, Vic.)

Thank you for your kind words. In March 1963 we presented an article entitled "Low Frequency Sampling CRO Adaptor." The File No. is 7/C/20. There have been no other relevant articles.

COMPONENTS DELAYS: For a number of years I have been ordering various equipment per mail. Actually, I look forward to receiving a copy of your journal each month, as apart from the articles, I find the adverts of interest also. However, I have found a number of firms whose mail order service leaves much to be desired. Why can't they streamline their services? My experience is that it takes two weeks to receive a parcel from Sydney or Melbourne and the delay is not at Brisbane GPO. Really now, Cobb & Co could do better. In the meantime, one has no indication that the letter has arrived. It would be a simple matter for the mail order firms to have a standard card, indicating in brief that the order has been received and receiving their attention. I know it would cost 10c but I feel most customers would be glad to part with this if they knew what was happening to their order. Surely this idea would be good business practice? (V.E., Indooroopilly, Qld.)

While we sympathise with you, we feel you are being a bit harsh on the suppliers. We cannot see how you can expect to have an order posted to Sydney, filled, despatched and posted back to Queensland in much less time. Your idea of a "receipt of order" card at first glance appears to have some merit—but your statement that it would cost 10c for this service is way off beam. In all probability, it would cost close to a dollar to do this.

When one considers that each order has to have one of these cards typed, stamped and taken to a post office it doesn't take much to realise that your order for five dollar's worth of bits and pieces is going to cost you far more than five dollars. Added to this is the fact that all the time taken for the card despatch could have been taken in filling your order in the first place, the supplier (and you) are really behind the eight ball. No, V.E., we can't agree that a card is the answer.

EDISON RECORDS: I have in my possession six old Edison cylinder records. They are approximately 4½in long by 2in diameter with a white ceramic looking base and bluish wax coating carrying the recording grooves. Could you tell me:

If they are of any value.

What was the speed at which they were rotated?

Were they cut literally or did they use the hill and dale method?

If they could be rotated at the correct speed, would it be possible to play these records with a modern ceramic cartridge on an arm?

Finally, could you supply a circuit to replace the dry batteries on older type sets. The set requires 3 volts and 120 volts (G.B. Charleville, Qld.)

We cannot supply much information about the records, although we have a few similar ones ourselves. They probably would be quite valuable to collectors of such items, or museums, particularly if they had a machine on which to play them.

We cannot help regarding the speed, though we seem to remember that Edison records in general were either "2 minute" or "4 minute" types, and that the blue ones were "4 minute" types.

They would definitely be hill and dale type cut.

To play them would require a former to rotate them and a tracking mechanism to move the reproducer laterally across them. The surface

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Actual size dyeline transparencies: $2 each. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-20 $20.00

Packing & Postage $1.00.

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: —10, +22 (at AC/10V) +20, +36 (at AC/50V). Upper frequency limit 7KHZ.
Batteries: Two 1.5V dry cells.
Complete with test leads

MODEL RH-80 $22.00

Packing & Postage $1.00.

20,000 Ohms per volt DC.
10,000 Ohms per volt AC.

Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

MODEL RH-60 $29.00

Packing & Postage $1.00

50,000 ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts; 0.25, 2.5, 10, 50, 250, 500, 1000
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 pc., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

"HANDYMAN" RH-150 $14.75

CHECKED PACKED & POSTED $15.50

Pocket size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS:

DC Volts: 2.5, 10, 50, 250, 1000. 10,000 ohms per volt
AC Volts: 10, 50, 250, 500, 1000. DC Current: .1, 25, 250mA. Resistance: 20K and 2M. Decibels: —20dB, +62dB, 0.7KHz.
Capacitance: .0001, 01, .0025, 25uF.

ELECTRIC CAR FAN

Latest model electric car fan, which plugs into the cigarette lighter on your car; has 4" blades. The base acts as a suction cap to fix it to your dash; also bracket for mounting on wooden base. Available for 6 volt and 12 volt cars. Specify the voltage required when ordering.

Packed and posted $4.75. Complete with wire & plug.

Order now, limited stocks.

SUPER DELUXE ● FULL-WAVE SOLID STATE ● MULTI-BAND PORTABLE RADIO A/C BATTERY

SPECIAL FEATURES:
Push Button Band Selector.
Sliding Volume, Tone & Squelch Controls.
Built-in Time-Zone Dial & World Map.
Twin Telescopic Antennas.
Twin Speaker System.
Fine tuning for SW 1-2 reception.

9 BANDS
1. AM Sports (535 to 1600 KHz).
2. MB Marine Band (1.5 to 4.0 MHz).
3. SW1 Ham (4 to 6 MHz).
4. SW2 World-Wide (6 to 12 MHz).
5. PB Low Band (30 to 50 MHz).
6. FM Music (88 to 108 MHz).
7. VHF1 Aircraft (108 to 145 MHz).
8. VHF2 High Band (145 to 174 MHz).
9. WB Weather (162.5 MHz).

SIGNAL TRACER/INJECTOR. MODEL SE-360.

SPECIFICATIONS
Gain: 60 dB.
Attenuation Factor: 0-20-40-60 dB.
Input Impedance: Over 75K ohms.
Output Impedance: Ext. Speaker 8 ohms.
Output: 600 ohms unbalanced.
Meter: VU 200uA.
Speaker: 2-¼" dynamic.
Power Supply: Dry Cell BL006P 9V x 1.
Size: 150 (5-13/16) x 85 (3-11/32) x 52mm (2-1/64").
Weight: Approx. 500gs (1.10 Lbs.). (SE-360 Injector portion)
Frequency: Approx. 1KHz square wave form.
Output Level: Max. 5V (0-5V continuously variable).
Note: Each unit supplied with test leads (Test prod x 1 and test clip x 1).

$35.00. Packing & Postage $1.00

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

INFORMATION CENTRE

is relatively soft and cannot exert lateral thrust without sustaining damage.

We suggest an old machine is the best place from which to start, possibly substituting the ceramic cartridge for the original head. If the cartridge has good vertical compliance, it should follow the modulation , but we have no data on the shape or radius of the original stylus.

We described a number of power supplies in the November 1964 issue, one of which may be suitable, with modifications, for your requirements. Reprints are available for $2.00 each. File No 2/PS/14.

COMPONENTS: A letter from R. M. of St Albans prompted me to write in agreement. I feel the hobbyist could do with more standardisation of components. With the variety around these days a man gets lost trying to sort through it all. It is nothing to start a project (old or new) and then find parts are out of stock, not made any more or have "never been heard of" by some retailers I know. I feel the current shortages are an indictment of manufacturers and suppliers of TV sets, radios, amplifiers, etc.

Advertisers must also come in for some criticism. One regular advertiser notified me the kit for their superhet tuner would not be available for another 3 weeks—yet I notice it is advertised again this month with no mention of delay. (C. L. Baxter, Vic.)

After having got all that off your chest you must feel 10kg lighter, C. L. Let's take your points in turn: Standardisation—we cannot see how there can be much "standardisation", as each component on the market is designed to do a specific job, and half the time we can't find one which does exactly what we want.

True, there is some duplication between brands, but this is a help, rather than a hindrance, as it follows one to use another type if the particular one is out of stock.

Maybe the component shortage is an indictment of parts manufacturers and suppliers for not looking far enough ahead with their programs—but in the current economic climate, who can blame them?

Don't be too quick to condemn the parts supplier because he cannot supply you with what you want. After all, it's not his fault. (He's the one losing your money!) Regarding advertisers not having components or kits advertised, let us point out some reasons: For the November issue of the magazine, deadline for "camera ready" adverts (in other words, adverts typeset and laid out, which require no work by us) was the 30th September. Assuming the advert took two weeks to have typeset and laid out, that means the advertiser had to start work on his November ad in the first week of September—the very latest he could change any copy would be the middle of the month. Therefore, there were six weeks between the time he finished his advert (using knowledge of existing stock) and the time it appeared in the magazine. With components changing from day to day, can you blame him if, after six weeks he found that the items were no longer in stock? Admittedly, it isn't always like this, but perhaps you could give them the benefit of the doubt.

NOTES & ERRATA

HOME STUDY COURSE—32 (July 1974, File No. 8/BE/33) The second paragraph in the centre column, p85, should read:

In order to overcome this, two modifications are made to the half line offset concept. First it is changed to quarter line offset. The multiplying factor in this case is 284 (higher because of the greater video bandwidth), so we have 284, less one quarter, 283.75. This is multiplied by 15,625, which gives 4,433,593.75. The second modification is to add the picture frequency, 25Hz, which gives 4,433,618.75Hz, or 4.43361875MHz, as the PAL sub-carrier frequency.

Function generator . . . from p54

the sweep facility can be tested. Connect an 8 volt DC power supply with approximately 2000uF of filter capacitance to the socket at the rear. The positive rail should connect to the positive rail of the generator, and the negative rail to the control input, pin 8. Care is required to ensure that no short circuits are made when this is done. If the load on the generator is earthed, the power supply should be floating, and if the power supply is earthed, the generator load should be floating.

Switch to the x1k range, and turn the power supply off. The generator frequency should be approximately 500Hz. When the power supply is switched on, the frequency should rise to approximately 20kHz. The actual frequency can be varied by changing the power supply voltage. Do not exceed 8 volts.

To obtain the frequency sweep, turn the power supply off. The frequency will fall exponentially, with a time constant determined by the power supply filter capacitance and the input impedance of the control input. By changing the range switch, the band of frequencies swept can be altered.

This glide tone can be used to evaluate the performance of amplifier and speaker systems. Since the output of the generator is of constant amplitude, any changes in the amplifier output level with frequency will show up as a changing level at the output during the sweep. Once the amplifier has been set level, any level changes in the speakers can be listened for.

This completes your versatile generator, so put your soldering iron away, and start experimenting!

Marketplace

FOR SALE

TAUT BAND MULTIMETER 34 ranges 20,000 ohms/volt, AC & DC current to 3A, 4 resistance ranges rechargeable battery. Price $25.50 plus tax. Product USSR. Technical & Scientific Eqpt Co Pty Ltd, Box 241E GPO, Melbourne 3001. 602 1885.

SPECIAL: VHF RF power amplifier, 200 mW in, 25 watts out at 13.8 volts, 50 ohms in & out (BNC connectors). Completely wired and tested in a diecast box and pretuned to 146 MHz. $40.00
UHF RF power amplifier as above but 300 mW in, 10 watts out pretuned to 436.5MHz. $45.00
VHF UHF spurious indicators, meter indicates if stage is taking off. $65.00
VHF RF power transistors: 2N5589, $4.60; 2N5590, $5.75; 2N5591, $6.90; or $16.50 kit of 3.
UHF RF power transistors 2N5945 (4 watt), $9.20; 2N5946 (10 watt), $13.80; 2N5645 (4 watt), $6.00.
Dow Key co-ax relays type 77-114, $11.50; 9pf miniature teflon trimmers, 30c; 13pf miniature ceramic trimmers, 20c; ¼ watt metal glaze resistors (lots of 10 only), 10 ohm to 180KO, 2c ea. Cash with order to: Willis Communications Pty Ltd, 13 Bishop St, Kelvin Grove, Q. 4059. Orders to $4.00 add 50c P & P, over $4.00 add $1.50.

DIGITAL ELECTRONIC CLOCK KITS: Includes seconds readout and attractive moulded black aluminium case only $38.00, write for details; also Sinclair stereo amp kits; 100W amps; leds; CMOS; IC's etc. G.M.R. PO Box 127 Malvern, Vic.

ELECTRIC CAR BUILDERS: High quality motors available, also technical assistance with construction. Write to Lower Hawkesbury NSW 2255.

COMPONENT RESOURCES: A wide range of local and imported parts available at low prices. For an obligation free quote send a detailed list of requirements to Box 143 PO Camperdown NSW 2050.

CALIBRATION SERVICE:
Haltronics offer a calibration service for digital meters and frequency counters to the following guaranteed standards: DC voltage to 0.05%; AC voltage to 0.1%; DC current to 0.1%; Resistance to 0.1%; Frequency to 1 part in 10^8 ie. 0.1Hz at 10MHz. Both commercial or magazine project instruments handled. Charges on an hourly rate. Haltronics Pty Ltd, 57 Sinclair St, Crows Nest, NSW, Ph. 02.92 0845.

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Alarm Modules, Electronic Eyes, Photo Sensitive Cells, Sonar, Gas/Heat/Smoke Sensors, Sirens, Bells, Pressure Mats, Door Monitors, Car/Caravan/Home/Office Holdup Factory Alarms, Key Switches, Reed Switches, Relays, Shock Recorders, Aluminium Tape. You Name it, We Have it.

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Phone: 977 6433 for information or send 50c in stamps for fully illustrated catalogue.

PROTECTOR R C ALARM SYSTEMS CO.

119-121 Pittwater Road, Manly, N.S.W. 2095.

TOA DRIVERS 15W 8 ohm inc Tfr; as new $15.00, see advert Wanted Column.

CASSETTES: Therapeutic, Motivational. Low cost. Many topics inc. Lose Weight; Stop Smoking; Stammering; Increase Confidence; Succeed; etc. Free extensive list. Home Education, 18E Polaris Drive. East Doncaster Vic, 3109.

RECHARGEABLE ELECTRIC TORCH plug in mains. $5.50 pp Ace Co. Box 24, Elizabeth 5112.

UNUSUAL "LIVE" OPERATIC RECORDINGS for sale: Don Giovanni W. Pinza, Carmen W. Ponselle, Medea W Callas, Iris, Saffo, Loreley etc. Send S.A.E. to H.S. PO Box 1600 Cairns, Qld 4870

DIODES: Special offer stock up on diodes, IN4004, IA, 400V, 10 for $1.30, 25 for $3.00, 100 for $10.00 P & P 25c. Dalby Electronics, PO Box 1 Ermington 2115.

MORE SUPER BARGAIN SPECIALS from MICRONICS. This month's specials—EM402—10 for $1.20, OA95—10 for $1.80. Digital I.C.'s: 7400, 7410, 7420, 7430, 7440—49c ea. TRANSISTORS at Bargain Prices—BC328, AS147—6 for $2. 2N1637(AF181), 2N1638(AF116), 2N1639(AF116), 2N218(OC45), 2N219(OC44), 2N371(AF115), 2N412(OC44), 2N591(AC128), 2N410(OC45), 2N2613(CV11011) — 10 of one type for $2.50, AS205 (BC107) — 10 for $2. TOP QUALITY PIGTAIL ELECTROLYTICS SALE. DON'T DELAY. 25uf/450v, 50uf/300v, 60uf/300v, 100uf/200v, 2000uf/25v — 3 for $2. 16uf/450v, 32uf/300v, 200uf/70v, 1000uf/18v — 4 for $2. 10uf/500v, 50uf/125v — 6 for $2. 1000uf/6.5v — 5 for $2. 2uf/40v — 10 for $1, 10uf/65v — 10 for $1.50, 40uf/70v — 10 for $2, 2uf/300 — 10 for $3, 500uf/25v — 10 for $2.50. TUNING CAP, Miniature — 2 for $1.30. Large 2 gang — $1.25, 3 gang $1.75. Slide Switch (18 pin) — 4 for $1. Trimmers (0-220pf) — 10 for $1.50. ZENER DIODES — 400mv, 4.7v — 10 for $1.80. COPPER CLAD Board 6" x 9" — 4 for $2, 6" x 12" — 3 for $2. SEMICONDUCTORS: BC 179, BC157 — 6 for $2, AC126 — 5 for $2, AC127 — 4 for $2, AD161/162 Mtchd Pr — $2, SE1010 — 5 for $2. DG14 Damper Diode for TV $1, 2N3730 — $1.25. AUDIO AMP I.C. incl. Cct Diagram PA234 1w R.M.S. — $1.25 ea., TAA 621 4w R.M.S. — $3. SLIDER POTS, single 250K/A — 35c ea. Stereo 5K/A — 75c ea.

SUPER BARGAIN PACKS. IDEAL FOR SERVICEMAN OR HOBBYIST TRANSISTORS: NEW, BRANDED, POPULAR pnp and npn Germanium types (Mixed) — 10 for $2. POWER RESISTORS 3w-7w, 5%, 10%. Top Qual. (Mixed) — 25 for $2. RESISTORS Fresh Stock (Mixed) Mostly 5%, 10%, ½w, 1w — 100 for 90c. POLYESTER CAPS, Top. Qual. 160v, 270v, 400v, 10% Tol. (Mixed) — 100 for $3.25. POTS — Dual, single, switch and Tab pots (No Rubbish) — 20 for $3.50. PRESET POTS: Mixed excel. quality — 10 for $1. CERAMIC DISC CAPS, mixed — 50 for $1 (incl. high voltage). ELECTROLYTIC CAPS mixed — 25 for $2. STYROSEAL CAPS — asstd for $1. TANTALUM CAPS — All mini, mixed — 20 for $2 (No junk). ZENER DIODES — Mixed 1w — 10 for $3.50, Mixed 10w — for $6. TAG STRIPS — Mixed — 50 for $2. COILS — Miniature Coils Osc. I.F. mixed, unmarked — 20 for $1.50. POLYESTER GREENCAPS, 10%, 1uf/200v — 10 for $2.50. Post and Pack 30c or extra for Heavy parcels. MICRONICS, P.O. Box 175, Randwick, N.S.W. 2031.

FILMS, sound 8-16. Sell, Exchange. Projector magnetic R/P Heads, raised pole non scratch. Halpin, 12 Swinburne Ave, Hawthorn, Vic 3122. 81 4724

CRYSTALS: 27.065 .085 .105 .125 .185 .240 .880 .890 .900 .910 $5.00 per pair post free. Timstrade, 9 Moore Cres, Faulconbridge 2776

READER SERVICE

AUSTRALIAN RADIO DX CLUB: For overseas and long distance shortwave and medium wave reception for serious DX monitors. Monthly bulletin. Send 20c stamp for membership details to ARDXC, PO Box 227, Box Hill, Vic 3128.

MULTIMETER & INSTRUMENT REPAIRS. Fast service to all makes of motors and test equipment including AVO & Japanese types. Western Meter & Instrument Service, 31 Hazel St, Girraween, NSW 2145. Ph Sydney 681 2092.

TRANSISTORIZED TV Service Specialist, Trade and Retail, also amplifiers and tape/cass. recorders. Layous Electronics; 294 Forest Rd, Bexley NSW. 59 4422.

WANTED

AWA Type Reflex Horns. Price to Wheller 29 Birdwood Tce, Auchenflower, Qld. 4066. Phone 70 1480.

DISPLAY ADVERTISEMENTS IN MARKETPLACE are available in sizes from a minimum of 6cm x 1 col rated at $45 per insertion.
Other sizes are at card rates.

CLASSIFIED RATES $1.50 per line per insertion payable in advance. Minimum two lines.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on-sale the first Monday of each month.

ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, ELECTRONICS Australia, Box 162, Beaconsfield, 2014.

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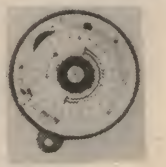

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240V 15 + 20 A CONTACTS
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$ 1.50 Vic. & QLD. $ 1.20

CLOCK DISPOSAL CO.
P.O. Box 147
LINDFIELD. N.S.W. 2070

NOTES & ERRATA

SIMPLE LOW COST AMPLIFIER (January 1975, File No. 1/MA/50) A number of errors occured in the capacitor portion of the parts list. A revised list of capacitors is given below:
1 100uF 25VW electrolytic
2 100uF 10VW electrolytic
1 470uF 6VW electrolytic
1 1000uF 15VW electrolytic
1 .0027uF LV ceramic
1 470pF LV ceramic
1 .1uF LV ceramic

SOCKET SPANNER SET

32 piece metric brand new ½", ⅜" + ¼" drive ratchet ext bar, T bar plug spanner etc in metal case only $5.95 set. Post A 95c, B $1.10, C $1.25, C $1.35.

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included
from **$1.60** each
P & P 20c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$26.00
(2 TELEPHONE SETS)

$1 cartage to rail. Freight payable at nearest attended railway station.

ALTIMETERS

Sensitive type ex Air-Force, made by Pioneer USA. $37.50.
Post: A $1.50, B $1.60, C $1.95, D $2.75.

TEN CHANNELS VHF TRANSCEIVER

Types TR 1934 100-125 MHz and TR 1936 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. **$33.00**

MINIATURE ELECTRIC MOTORS

1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
75c each or 10 for $5
P & P 20c ea. or 10 for 55c.

AIRCRAFT CLOCKS

Genuine Eight Day Jewelled movement, sweep second hand and start of trip indicator. Dash mountings. Ideal for car rallys.

$22.50 P & P $1.05.

"PLESSEY"

Producermatic 2" professional endless cartridge replay machines 2 track stereo with third cue track for machine coontrol (auto-stop etc.). 600 OHM line level outputs. 240V AC operation. All silicone transistors 7½ I.P.S. 19" rack mounting. 60Hz (240V) Model $65; 50Hz (240V) Model $90. Ideal for tape idents, background music, etc. $1 cartage to rail. Freight payable at nearest attended railway station.

TELEPHONE WIRE

1 mile twin(2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $1 cartage to rail freight payable at destination.

PRISMATIC COMPASSES

Genuine ex-army Mk 3, liquid damped, as new **$29.50** P & P $1.05.

MORSE KEY $1.40 Post 20c. | **MORSE KEY BUZZERS** $4.25 Post 55c.

HALF INCH RECORDING TAPE

Top Grade 2400' on 10½" reels. Ideal Video Experimenting. Only **$3.50** per reel.
P & P A. $1.55, B $1.60
C. $1.95, D. $2.75.

UNI-SELECTORS

4 bank 25 position **$4** each.
P & P A. 70c, B. 85c, C. $1, D. $1.10.

ADLER FREQUENCY METER

100KHz 20MHz **$95**

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

$1.25 each. P & P 30c.

NIBBLING TOOL

Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16inch.

ONLY **$7.85**
Post 55c

NIFE CELLS

1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.
$1.50 each
P & P 30c.

BC221

Frequency Meters.

$35.00

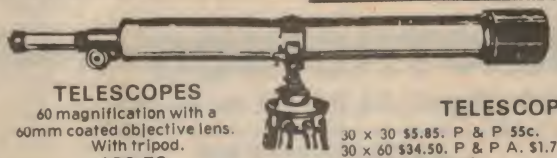
HANDY SIGNAL INJECTOR

Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On-Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only
$6.50 Post 55c

P.M.G. TYPE KEY SWITCHES.
45c P & P 20c

TELESCOPES ZOOM FOCUSING

25 x 30 **$19.95** — 40 x 40 **$28.95**
50 x 50 $37.50, 60 x 60 $75.00
P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.



TELESCOPES

60 magnification with a 60mm coated objective lens. With tripod.
$39.50
As illustrated.
P & P A. $1.55, B. $1.75,
C. $2.25, D. $3.25.

TELESCOPE

30 x 30 $5.85. P & P 55c.
30 x 60 $34.50. P & P A. $1.79, B. $2.20, C. $2.40, D. $2.70.

WALKIE TALKIES

2-way radio, 7 transistor, PMG approved, set of 2 only **$48.50**

1 watt, 11 transistor $130.00 set of 2.

P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

SMALL COMPUTER PANELS

3in x 2in containing 2 valves, qty. of resistors, etc.
ONLY **75c** P & P 30c.

ELECTRONIC FREQUENCY COUNTER

Austronic type DFC-4 240V 50 cycle 0-100KHz **$150**

IMPELLER PUMPS

New gunmetal body, Stainless Steel Shaft. Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self prining. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5"

⅜"	$19.95
½"	$22.75
¾"	$27.50

P & P A. $1.45, B. $1.60, C. $1.75, D. $2.

FREQUENCY METERS

AN URM 32 A 120 KHz to 1000 MHz, with two 40V power supply, $125.00. $1.00 cartage to rail, freight payable at nearest attended railway station.

CONDENSER LENS

2½in DIAM. 2in FL. $1.50 each. Or $2.50 per pair. P & P 20c.

522 Transceivers 100-150M CS

$35.00

Cossor Double Beam Oscilloscope 1035 Tested **$150**

LOUD HAILER

Battery operated, transistorised. In good used condition $27.50 Post A 70c, B 85c, C $1, D $1.25.

POSTAGE KEY:

A: NSW.
B: Vic, Qld.
C: SA, NT, Tas, New Guinea,
D: WA.

VALVES

BRAND NEW IN CARTONS

807	$1.50	CV850 $1.50
65N7GT	95c	1H6G 75c
5U4G	95c	832 $5.00
EF50	75c	6AG5 80c
5Y3	$1.99	6X4 $1.00
2 x 2	75c	VR64 75c
		VT4C 75c

P & P 30c

PARABOLIC REFLECTORS PYREX MIRROR

36" dia. Ideal solar radio optical experimenting also decorating purposes. $37.50 Sorry shop sales only.

RADAR TRANSCEIVER

X BAND WITH KLYSTRON ETC. **$45.00**

5" CRO TUBE

5 BPI $5.50 each.
Post: A 85c, B $1.10, C $1.25, D $1.35.

CHASSIS PUNCH SET

Five sizes: ⅜ inch, ¾ inch, ⅞ inch 1 inch and 1⅛ inches. With taper reamer. **$17.95**
P & P A. $1.45, B $1.60, C. $1.75
D. $1.85.

SELSYN MOTORS MAGSLIP

Md. 11 ..... $5.25 ea.
No. 19 TWO-WAY RADIOS.
Power supply, accessories, etc., $35.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

7 x 35 Wide Angle	$35.50
8 x 40 Wide Angle	$39.50
7 x 50	$31.50
10 x 50	$32.50
12 x 50	$33.65
20 x 50	$37.95

P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

3000 TYPE RELAYS

P.M.G. 200Ohms — 1'500Ohm Coils $2.50 each. P & P 30c.

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only $3.50 each, post 55c.

Cintel Oscillator and Electronic Counter, type 388.

$250

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.95. We haven't got time to sort them, so you reap the benefit.
P & P A. 60c, B. 85c, C. $1, D. $1.10.

CONDENSER LENS

1½in diam. 1½FL. 50c each.
P & P 20c

MULTIMETER

A compact and handy tester for workshop or lab where quick circuit checks are required
DC Voltage 5-2.5K (20,000 OHMS per volt) AC Voltage 10-1000V (10,000OHMS per volt) DC Current 0-50 UA. 0-2.5 MA, 0-250 MA. Resistance 0-6 Megohms Capacitance 100 UUF to 1UF. Decibels — 20 to plus 22 DB. Complete with instructions.
Only $15.95 ea. Post $1.05.

EX ABC RECORDING TAPES TOP BRANDS

¼" x 1200' on 7" reels. **$2.50**
¼" x 2400' on 10½" reels. **$4.95**
P & P A. 72c, B. $1.05, C. $1.15, D. $1.30

SOLENOIDS

Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio. etc.
$2.50 P & P 20c
200 MA 24 volt, ⅛in push movement.
$2.50 P & P 20c.

ZOOM FOCUSING MICROSCOPE

Battery and mirror illuminated 900x magnification. Complete with dissecting kit slides etc.
P & P A. $1.45, B. $1.60,
C. $1.75, D. $1.85. **$29.95**

TRANSCEIVERS Ex Army

No 10 set, 38 to 55MHz with hand piece $22.50. Battery to suit $3.50 extra.
No C42 set, 36 to 60 MHz complete with 24V power supply, headphone, mic, leads etc $65.00.
No C45 set, 23 to 38 MHz complete with mast, headphones, mic 24V power supply etc. $95.00.
$1.00 cartage to rail, freight payable at nearest railway station.

Crystal Earphone **75c** P & P 20c

Cassette head cleaners **$1.50** P & P 20c

5" SPEAKERS

8 OHMs 5 watts flush mounting with attractive bakelite cover plate mounting screws and 6ft connecting wire $4.50 ea or two for $8.50.
P & P A. $1.02, B. $1.35, C. $1.45, D. $1.60.

COMMUNICATIONS RECEIVER

TCA R5223 Communications Receivers. These receivers don't cost as much as a R390 A or a RACAL but give you the opportunity of having a unit with a similar performance at a fraction of the cost. Continuous tuning from 1.5 to 30.5 Mhz. bands. First conversion is crystal locked into a 2.5 to 3.5 Mhz tunable second IF. 1 uV sensitivity. Drift from switch on to fully warmed up less than 3 Khz. Dial reset to less than 1 Khz. Calibration to within 3 Khz. (typically within 1 Khz.). Operation from 240V, 110V AC or 24V DC with inbuilt power supplies. 19 inch rack mounting. Accepts coaxial 50 or 75 ohm antennas. Diversity operation possible IF output for panadaptors etc. Complete with leads, headphones a bargain at $250.00 Cartage to rail $1. Freight payable at nearest attended railway station.

ALLIGATOR CLIPS

Sets of two with 14" connecting wire. 5 sets for $1. Post 24c.

TRANSPONDER APX6

with Lighthouse Tubes. Can be converted to 1200 MHz. **$17**

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

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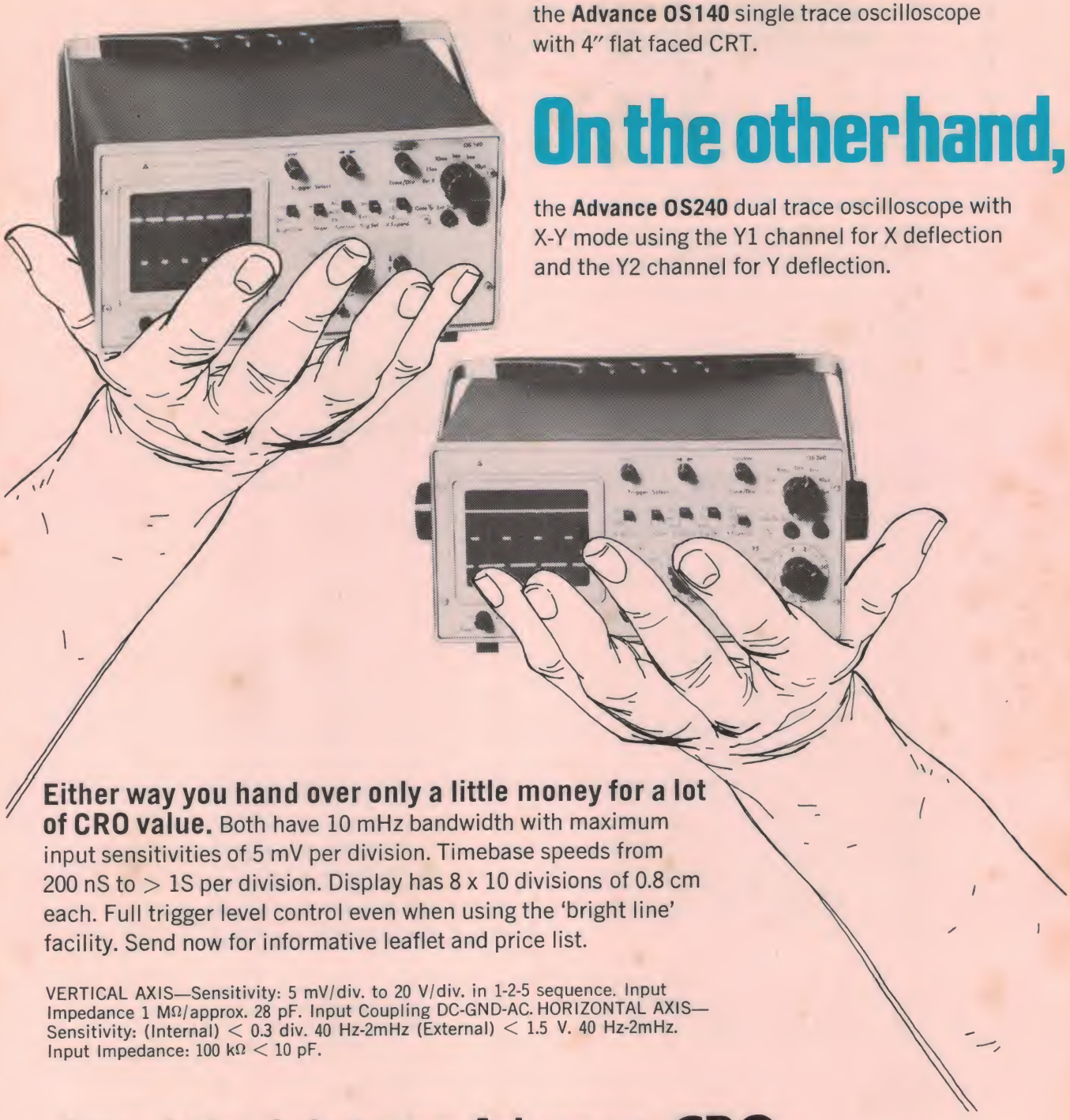
On one hand,

the **Advance OS140** single trace oscilloscope with 4" flat faced CRT.

On the other hand,

the **Advance OS240** dual trace oscilloscope with X-Y mode using the Y1 channel for X deflection and the Y2 channel for Y deflection.



Either way you hand over only a little money for a lot of CRO value. Both have 10 mHz bandwidth with maximum input sensitivities of 5 mV per division. Timebase speeds from 200 nS to > 1S per division. Display has 8 x 10 divisions of 0.8 cm each. Full trigger level control even when using the 'bright line' facility. Send now for informative leaflet and price list.

VERTICAL AXIS—Sensitivity: 5 mV/div. to 20 V/div. in 1-2-5 sequence. Input Impedance 1 MΩ/approx. 28 pF. Input Coupling DC-GND-AC. HORIZONTAL AXIS—Sensitivity: (Internal) < 0.3 div. 40 Hz-2mHz (External) < 1.5 V. 40 Hz-2mHz. Input Impedance: 100 kΩ < 10 pF.

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Excellent frequency response
and all the power you need

Unquestionably, the SU3500 from TECHNICS is one of the most eyebrow-raising stereo amplifiers on the market today.

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The SU3500 houses all the latest advances in audio amplification starting with an ultra low distortion of 0.08% THD.

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A full 86 watts RMS output gives you all the power you need.

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